THE GETTY CENTER LIBRARY

Why ask for the moon
when we have the stars?

AS

CONSERVATION OF LEATHERCRAFT AND RELATED OBJECTS

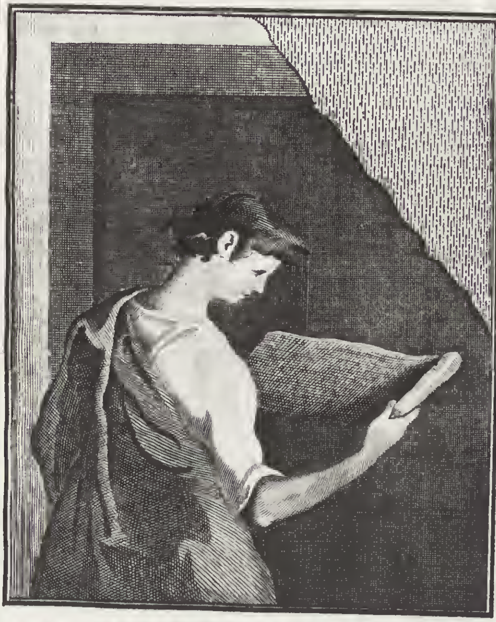
Coordinator : T. Stambolov (Netherlands)

Members : C. Chahine (France)
C. Clarkson (USA)
G. Dijkstra (Netherlands)
R. Guilly (France)
P. Hallebeek (Netherlands)
T.M.Løken (Norway)
G. Møller (Denmark)
K. Nikitina (USSR)
R. Reed (UK)
E. Schaffer (Canada)
W. Schmitzer (FRG)
H. Van Soest (Netherlands)
Z. Szalay (Hungary)
D. Tilbrooke (Australia)

Programme 1978-1981

1. To promote responsible conservation of leathercraft products and artistic and archaeological objects of leather as well as other objects through communication among the members.
2. To encourage the exchange of experimental findings or other relevant information providing this does not interfere with the sovereignity of a particular work or with the priority reserved for the publishing of this finding.
3. To examine the merits of available methods and to develop new ones in matters concerning the salvage of dry, pulverising archaeological leather finds.
4. To broaden the knowledge on leather manufacture in order to obtain a better understanding of the causes of leather decay, in particular the red rot.
5. To study the conditioning of leatherwork with respect to exposition and storage.
6. To refine the composition on leather dressings employed in the treatment of decaying leather.
7. To assess existing training programmes and to stimulate their development by propagating themas as well as by translating the instructions on which they are based into various languages.

CONS.
N
8554.5
I61
C73
1981
v.4



THE J. PAUL GETTY MUSEUM LIBRARY

THE J. PAUL GETTY MUSEUM LIBRARY

WORKING GROUP OF CONSERVATION OF LEATHERCRAFT AND RELATED OBJECTS

Coordinator: T. Stambolov
Central Research Laboratory for
Objects of Art and Science
Gabriël Metsustraat 8
1071 EA Amsterdam
the Netherlands

INTRODUCTORY REMARKS

A particulary instructive work in point is the "Conservation of leather, skin and parchment", published by the Konservatorskolen Det Kongelige Danske Kunstakademi, Peder Skamsgade 8, 1050 København, 1980. It contains the text of 26 lectures and intends to inform restorers - who are supposed to look after collections including among other things, also leather objects - how to study and detect deterioration, arrest its expansion, prevent disintegration and thus conserve properly all leather items of artistic, archaeological and bookbinding inherence. Although the purpose of the organizers of this training course is allegedly only to initiate the interested restorers in the field of leather conservation, the digest in question, presents highly relevent well documented and thorough coverage of subjects as composition of the animal skin, its possible defects and discoloration, structure, chemical composition of skins and hides and all stages needed to manufacture them into leather or parchment. Likewise methods of analysis - some of them quite sophisticated and certainly beyond the reach of restorers - are described at length. The major part of this syllabus is, however, devoted to the conservation of the leather varieties. The archaeological leather receives, rightly, a very extensive attention, as it presents many, often unsurmountably problems. Pretreatment, cleaning, dehydration, stabilization, impregnation and conservation of waterlogged leather are therefore explained with view to the intention to archieve a responsible upkeep. Even the removal of old conservation mediums such as British Museum Leather Dressing and Neutralfett SSS (which proved difficult) and Polyethyleenglycol (which is to be extracted from the leather in alternate baths of ethanol and water) is described. Ethnographic leather, gilt leather, garments and shoes of leather and parchment are also dealt with in full detail.

E. Jägers in her lecture "On the deterioration after treatment of painted leather wall-hangings in three castles in Rhineland" (IIC Vienna Congress 7-13 September 1980:Conservation within Historic Buildings) draws attention to the damage that might be inflicted to such leather by the very dressing used for its conservation. In this case the neat's-foot oil which was rubbed in the back of the hangings, permeated the leather and spoilt the paint layer in front by rendering it soft swollen and sticky.

H. van Soest and P. Hallebeek at the same IIC Vienna Congress (see Proceedings: The Restoration and Conservation of gilt Leather, pp. 162 - 165,) report on their progress in the analysis investigation and conservation of gilt leather wall-hangings.

Z. Szalay in his "Conservation and restoration of dyed and embossed leather objects" presented at the same IIC Vienna Congress, conveyes a critical evaluation of the components participating in the compoistion of fat liquors, that is oil-in-water or water-in-oil emuls[illegible]. Advantages and disavantages of the alcohols as emulsion ingredien[illegible] are considered to be very important in this context, are assessed, and after that the findings of Szalay are put forth to justify the formulation of a optimal leather dressing, which should contain: 1500 ml. buthyl alcohol, 8 g cetyl alcohol, 20 g crude neat'-foot oil and 3 ml cedarwood oil. These are intimately mixed with 50 ml of water.

W. Schinitzer writes well-informedly and exhaustively ("Restaurierung von Schattenspielfiguren" - Arbeitsblätter für Restauratoren, Heft 2, 1980) about the "shadow puppets" - the protagonists in the shadow plays, popular in China, Japan the Malay Peninsula and Indonesia. The writer explains that the puppets are cut out of hides which are prepared in a manner similar to that employed in parchment making. The wet hides are stretched on wooden frames and are allowed to dry slowly under tension. As far as the Malaysian and Indonesian types of puppets are concerned the hides of which they are made are reduced in thickness to 0,5 - 1,5 mm by shaving them. The puppets are then painted in the desired design with tempera i.e. mineral pigments and egg white. Cracked paint or paint layers that tend to flake off are consolidated with diluted egg white (one egg white is dissolved in 60 - 70 ml of water and left to stand for 24 hours in a covered vessel This fluid is then applied on the damaged areas. The areas on the puppet treated thus are covered with silicone relined paper and fur[illegible] pressure-fixed by means of a hot spatula (temperature corresponding to the mark: synthetic fabrics on the dial of a pressing iron). The Chinese shadow puppets are in contrast to the Malaysian and Indonesian transparent because the hides intended for puppets are finished by rubbing them in oil. Their thickness varies from 0,1 to 2 mm depending on the particular Province in China and the decorations on them are drawn not with paint but with dyes, which stay transparent like the hide and thus do not obstruct the passage of light through the puppet a requirement that is essential to the Chinese fashoin of shadow-theat The conservation of such puppets is usually limitted to massaging of oil of vaseline into them.

W. Stayman has accomplished a close survey of the materials and techniques involved in the manifold approach of softening and dressing of leather, parchment and fur, in her all comprising monograph (Softening of Eskimo Seal Fur Skin Artifacts. A report submitted to the Department of Art in Comformity with the requirements for the Degree of Master of Art Conservation. Queens University Kingston, Ontario, Canada, November 1977). Besides the systematically arranged rich information, which undoubtedly will be of much help in conserving well objects of leather, parchment and fur, the author had also the good sense of adding as an appendix to this publication her correspondence with manufacturers of the products, she had carried out her experiments with. The result is an amusing and at the same time instructive exposure of the often irrelevant incompetent and misleading explanations that are it appears commonty given in reply to such inquiries.

81/19/1

THE PRINCIPLES OF RESTORATION OF UNIQUE BINDINGS

Endel Valk-Falk

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Conservation of Leathercraft
and Related Objects

THE PRINCIPLES OF RESTORATION OF UNIQUE BINDINGS

Endel Valk-Falk

Estonian State Art Museum
Tallinn
USSR

Practically every large library has a department of rare collections. The uniqueness of the binding of a book is one of the many attributes that contribute to its rarity. In the process of its restoration it is imperative that all the details of a binding's construction as well as all its parts be preserved to the maximum. In order that these bindings, when to be restored, be handled by restorers with correspondingly sufficient skill and qualifications, the author proposes here a method of evaluating the uniqueness of such bindings as well as their state of preservation, and to group them accordingly.

Depending upon their state of preservation, the unique bindings can further be divided into 4 groups. The aims of their restoration are:

1) to stop the further process of deterioration by chemical means, and provide ideal storage conditions and protective cases,

2a) to restore the bindings as near to their original state as possible with the aid of modern materials and techniques,

2b) to reconstruct the binding to fairly resemble the original with the aid of preserved details and impressions, and

3) an attempt to create a 'new binding in the old style' on the basis of some analogy, i.e., eclectics or to create a new binding in a completely new style.

It is only subsequent to the determination of the uniqueness, the state of preservation and the principles of restoration that the required methods of restoration should be decided upon. Whatever the methods chosen, they should be such as to ensure minimum possible alterations to the characteristics of the binding.

The pride of every book collection - those of libraries, museums and private collections included - is its rare books. These are displayed at the exhibitions and demonstrated to the visitors. They are afforded the best available storage conditions and exhibition facilities and, when required, restored by the most competent restorers.

The historical value of a book and its rarity are determined by such factors as its age, the number of its existing copies, its authorship, originality of the text, its provenance, etc. In addition, other factors, e.g., illustrations, script (design, type) and uniqueness of the binding (style, craftsman,etc.) determine the book's artistic value and considerably contribute to its rarity. Apart from valuable binding materials, the binding boards may be decorated with precious stones, metals and ivory. Other essential attributes of uniqueness are the unparalleled technical realization of the binding and the richness and craftsmanship that have gone into its parts (fly-leaves, headbands, edges, etc.).

The afore-mentioned well-known attributes of a rare book have generally been long-ascertained everywhere on the basis of the local distinctiveness and universally accepted principles of rarity.

As the present article deals with the rarity of a book from the viewpoint of only one of its characteristics - the uniqueness of binding - I suggest using Table 1 (see pg. 9) to determine this characteristic and group unique bindings into 4 groups accordingly. The maximum total points that any binding can receive are 100 - this binding would be amongst the most unique bindings existing - and the minimum number of points 1. Since the binding resorers in the U.S.S.R. are accorder 4 different Category Certificates of competence - III, II, I and Higher, the uniqueness of bindings is also divided into 4 groups: in the first group belong the bindings which have a total of 1-20 points, second group 21-40 points, third group 41-70 points, and the fourth group 71-100 points. Such a classification facilitates allocation of unique bindings to be restored to restorers with differing degrees of competence. The most unique books (71-100 points) are handled by the most competent restorers having Higher Category Certificates, and so on.

Should only one or two attributes fall in the third or fourth groups of Table 1, the binding to be restored should first be processed by the experts in the corresponding field (gilder, a metal smith, etc.) in consultation with the restorer who would process the binding further so that the most unique features be best preserved.

One of the characteristics of the rarity of a book is its age. Very often, though not always, the extent of deterioration, and sometimes even other damage to the binding, corresponds to its age. In addition to chemical, biological and mechanical deterioration of the binding, the book may have been re-bound, which may considerably decrease the uniqueness of the binding.

The unique bindings to be restored may further be grouped on the basis of the originality of the binding as follows:

1) The binding is original, or
2) The binding is preserved in an altered state. Either
   a) the binding is new and has different attributes as compared to the known or presumed original, or
   b) the body of the book has been re-bound with the binding of some other old book, or
   c) only the body of the book has preserved - the binding is detached and lost or deteriorated or damaged beyond restoration or reconstruction.

The bindings falling in 2nd group here cannot generally be accorded as much value for uniqueness as those in the 1st, i.e., original bindings. In case of 2a and 2b, there do exist, however, cases where the second binding is even more unique than the original from the standpoint of their technical realization and/or binding materials used. In such cases, of course, they should be treated on par with the original.

The choice of conservation and restoration methods of a unique binding depends, in addition to the degree of its historical and artistic value, i.e. the degree of its uniqueness and its materials, on the state of its preservation. Just as in order to determine the degree of uniqueness of a binding, the degree of uniqueness of its every single detail was considered in Table 1, in order to determine its state of preservation, the degree of damage or deterioration of every part of the binding should be determined seperately. For this, I propose using Table 2 (see pg. 10). The maximum points to be alloted for maximum damage of any one king (chemical, mechanical, etc.) to any one part is 10 and the minimum 0. In order to arrive at the total damage to any one part, add the points alloted for each kind of damage and divide by 4. Add the resulting points for total damage to each part to obtain total damage to the binding. To obtain the per cent state of preservation, subtract this total from 100.

If the value of the state of preservation of a unique binding is far less than 50%, the possibility and the necessity of øits full restoration is questionable. In such a case it might be better to limit the processing to conservation treatments or provide it a protective case and ideal storage conditions so as to protect it from further damage and deterioration. This can be carried out by IInd and IIIrd Category restorers.

If the state of preservation is such where no portions of any part is missing but the parts have only been weakened and need to be strengthened, the binding may also be entrusted to IInd and IIIrd Category restorers.

If the value of the state of preservation of a binding is rather low and very large portions of many parts are missing but the historical and artistic value of the book itself very great, complete reconstruction of the binding should be considered. This can be entrusted to only Ist Category restorers.

If the value of the state of preservation is more than 50% and the portions of the details missing not very large, complete restoration of the original forms and attributes should be undertaken using the best available materials corresponding as far as possible to the original ones. Modern materials should only be used if proved to confirm to the aims and principles of restoration. This should be entrusted to only Higher Category restorers.

What should be the aims of restoring a unique binding?

a) Preservation of the manuscript text (incunabula or first printing),

b) Easy handling of the book, i.e., its good openability for reading, microfilming, reproduction,etc.,

c) Preservation of the characteristics of the style of the binding, and

d) Increasing the permanence/durability of the binding.

Unfortunately, the question whether a rare book or binding requires restoration is not always determined by a competent committee but a single custodian of the rare books department. And it often happens that the intentions behind this has been only the consideration of the needs of of the readers. The restoration of the aesthetic integrity of the book or a binding, requiring detailed research into its construction history and materials, have not even been contemplated.

In order to achieve the above-mentioned aims of restoration, the afore-mentioned state of preservation of the binding should be taken into consideration. From this standpoint there exist three principles for preservation of unique bindings: they are

I) to stop the process of deterioration of the binding. The pre-requisites for this are well-equipped chemistry, microbiology, photo, etc. laboratories. The co-operation of experts from diverse fields should help elaborate the desired methods and enable the restorers to undertake the required treatments for conservation. Furnishing the qualities of permanence and durability to unique bindings with the help of modern chemistry without supplementary binding operations and additional materials would be ideal. Creation of the required storage conditions (environmental, climatic,etc.) is one of the principle means of ensuring longevity. Protective cases play a major role in the preservation of the original bindings. Very often it is upon the construction design and materials of these cases that the fate of the unique binding depends.

IIa) The most complicated task is restoration of the binding when some portions of its parts are badly damaged or missing. In order to restore the original attributes of a binding, research into all its aspects followed by fixation of its existing attributes of style are essential. Only then a decision can be reached at as to what the restored binding should look like.

IIb) The task involving a great amount of responsibility, however, is reconstruction of a binding very little of the original of which has preserved. Here an important role is played not only by knowledge of the art and science of binding but also by chance. What I mean by chance is the possibility of the reconstruction of, say, leather binding composition with all its individual tooled designs, and this with the aid of some chance impressions or characteristics preserved on another binding part, e.g., covering boards. It is not always in such cases that clear impressions can be detected on the covering boards, as this depends upon the craftsman of the time (amount of pressure applied while tooling) and the hardness and the receptivity to pressure of the wood of the boards, etc. However, experience has shown that in a majority of cases the general design is clearly traceable from the existing boards and the reconstruction of the design thus possible on new vegetable-tanned leather covers. At the least the general outline of the original design should be transferred with the aid of a fillet to the new covering leather so as to ascertain and fix its historical provenance. Here serial bindings are an exception, as duplicating the design is possible in almost all its complete details.

III) If the binding is completely missing or has been damaged beyond any hope of salvation or the book has been repeatedly re-bound, the last existing binding not being in harmony with the rest of the book and having no uniqueness of feature as opposed to the known or presumed uniqueness of the original or if the body of the book is exceptionally unique, the book then should be provided with a new binding in the so-called Ø 'old style' or one that harmonizes with the characteristics of the age and the body of the book.

Should in such cases reconstruction of 'the old style' on the basis of any existing distant feature or impression, etc. not at all be conceivable, the restorer should boldly create a new binding with the objective of furnishing ideal binding characteristics ensuring that it is in harmony with the body of the book.

Here varying results may be achieved depending upon the personal taste of the restorer and the choice of materials. If the restorer has sufficient artistic, historical and technical training and is able to create the elements of style (construction, sewing, headbands, clasps, bosses,etc.) with a sense of piety, the result could be praiseworthy.

A restorer with insufficient training, however, is inclined to exaggerate with the creation of the so-called 'old' elements, very often committing errors pertaining to the essential peculiarities of a style and age, and ignore the principles of permanence and durability. There are cases where some authors suggest the deplorable practice of artificial ageing of new covering leather. Many modern materials (chrome leathers with nitro-lacquers) do not permit duplication of some of the older techniques such as blind-tooling. The result in such cases is eclectics or unpleasant imitation.

The profile of the boards, the choice of the directions of the annual rings of wood, their hardness, the position of the clasps, etc. have fixed characteristics in each style and age. All these combine to form the total characteristics of any given age or school. Error in any one important detail may mar the final outcome. Thus, a thorough knowledge of the style characteristics and the fixation of every nuance contribute to the uniqueness of the newly created binding, enriching in its turn the book itself.

Ever more new bindings are created in the 'old style' and the results are but mediocre. When expert binder-restorers are not available use of modern constructions with the aid of modern materials and glues should be rather preferred in creating new bindings and protective cases. The new binding should, of course, confirm to the aims set out earlier. I would not like to spell out here any particular binding method as such. The two thousand years' old history of binding should be sufficient to give us an account of the advantages and disadvantages of various styles and methods of binding. It only remains to be hoped that such new styles will be appreciated by the custodians of rare books.

If the book requiring restoration has been evaluated as per the afore-mentioned tables and the degree of uniqueness and the nature and extent of damage established, it is then the restoration council that should decide the methods and materials to be employed. Today the restoration practice has, at its disposal, a large variety of methods, and the result would depend upon a correct choice. If either the techniques of a book (intaglio, miniature paintings,etc.) or its materials (chamois, etc.) do not permit use of strong pressure or certain glues, such methods and materials should definitely be avoided. During restoration great care should be taken to preserve the finest nuances of the entire book-the depth of colours, grain, compactness and shade of paper, relief of the text and illustrations, etc. The stylistic characteristics should remain unaltered while resewing a binding. Thus, the spines of the Greek-Slavonian bindings should not be rounded or the body of the book should not extend beyond the covers after restoration. Often a problem arises as to what should or should not be done. It is impermissible to recut the body of the book but it is equally impermissible to alter the proportions of the covers by adding new strips to the boards. A mistake then has somewhere been made. The error of one restorer is compounded, bringing about a number of alterations of the original characteristics. What is the solution? for often a restorer alone is called upon to solve a number of practical questions in the process of restoration. One of the solutions lies in imparting thorough training to the restorers by probationary periods under expert binders and restorers. Another is group practical seminars in binding restoration at libraries, archives or museums. On the Ascona seminar model, such seminars have been held in Estonia and, in 1980, one was held in a manor-museum Arkhangelskoe near Moscow, in which many experienced restorers from various major restoration centres of the U.S.S.R. participated. During the seminar the methods, tools and materials being used by various restorers were studied. And the organizers of the seminar profited by almost 300 bindings being conserved.

The experience of the Soviet restorers should enable them to organize in future larger regional practical restoration seminars for bindings of common stylistic characteristics - such as Greek-Slavonian bindings, incunabulas, etc. In this way principles and restoration practices can be further evolved and developed, the beneficiaries of which would extend much beyond the participating restorers and owners through better preservation of unique bindings - those awe-inspiring legacies of our generation - for centuries to come.

Table 1.

Binding Attributes	Increasing degree of uniqueness, in points			
	1-2	3-4	5-7	8-10
1) Type of binding: boards, codex, pouch binding, chain-book, block-book, etc.				
2) Binder: well-known/unknown				
3) Provenance: hand-written notes, ex-libris, supra libro, etc.				
4) Age: dated/presumed.				
5) Covering material: vegetable-tanned leather, white leather, alum-tawed skin, morocco, parchment, textiles(silk, velvet, brocade), precious metal or bone plates.				
6) Decorative techniques: blind- or hand tooling, gilding, batik, intarsia, filigree, embossment.				
7) Decorative hand-made paper for fly-leaves, etc.				
8) Headbands made by hand				
9) Bosses: corners, clasps, chains, decorative studs, nails, etc.				
10) Edges of the body: gilded, ornamented, coloured, etc.				
Total points:				

Table 2.

Part of the binding	Nature and Extent of damage				Total damage
	chemical a.	mycological b.	entomological c.	mechanical d.	$\frac{a+b+c+d}{4}$
1) Covering material: leather, parchment, textile, metal, etc.					
2) Covers: wood, pasteboard, papyrus, etc.					
3) Spine					
4) Bosses: metal, precious stones, decorations, etc.					
5) Sewing					
6) Headbands					
7) Fly-leaves					
8) Book edges					
9) Illustrations					
10) Other accessories: book-marks, protective cases, etc.					
Total points:					

State of preservation in % = 100 - Total points.

81/19/2

CONSERVATION OF ARCHAEOLOGICAL LEATHER IN THE STATE HERMITAGE MUSEUM

K.F.Nikitina

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Conservation of Leathercraft and Related Objects

CONSERVATION OF ARCHAEOLOGICAL LEATHER IN THE STATE HERMITAGE MUSEUM

K.F.Nikitina

The State Hermitage Museum
191065 Leningrad
USSR

Abstract

The paper is based on the experience of leather conservation in the Laboratory for restoration of archaeological findings made of organic materials. Some methods of the evaluation of the preservation condition of dry and wet archaeological leather, the classification of the leather according to the degree of its deterioration as well as the technique of conservation and restoration of leather objects are given.

The variety of archaeological leather objects brought to the laboratory for restoration, their different historical and artistic value and scientific importance, the unique properties and qualitative features of the leather as material in every separate case, the different state of the preservation of the findings, - makes it necessary to arrange them into classes.

Archaeological leather found in various conditions differs, first of all, in the moisture content. Characteristic of the findings from Novgorod, Pskov, Staraya Ladoga is high moisture content, whereas objects from Middle Asia, Northern Caucasus, Altaj burial mounds, Khakass Autonomous Region are characterized by dryness.

To decide the technique for leather conservation, we conditionally divide the findings into two groups: wet and dry. The objects dried when kept in repositories are also included in the latter group.

Of basic importance for conservation is the classification of objects according to the state of their preservation. We define three degrees of preservation: good, middle and poor. In practical work, it is very seldom that the preservation of the object can be defined in one way. For example, a woman's fur coat from Oglakhty (Ist century B.C. - I st century A.D.)demonstrated all stages of deterioration. The upper part of both coat-breasts preserved well (the losses here resulted from the action of rodents and insects and from mechanical breaks), the losses on the skirt part of the coat and on the back are of quite a different character and origin. They are the result of decomposition.

The state of preservation of leather depends, in main, on the following factors:

- the material itself (its kind, preliminary processing - method of dressing and tanning, on the degree of wear when the object was used etc.);
- the conditions in which the finding lay buried (moisture, salinity of the soil, nearness of other materials);
- the adequacy of field conservation, packing and transportation;
- the conditions of their keeping (the influence of the temperature-humidity regime, light, cleanness of the environment, and others);

There are no methods for determining the degree of preservation of archaeological leather objects. The absence of such methods can be accounted for by the difficulty in getting samples of the same type and of the same degree of preservation, even in having some approximate comparable data. There is a number of analyses which, strictly speaking, cannot be performed on samples of archaeological leather.

As a rule, organoleptic methods which require much practical experience, microscopic technique and tests on water-solubility are used in our laboratory to estimate the presrvation degree of the objects.

By organoleptic methods of estimation of the preservation condition of archaeological leather it is possible to determine mechanical damages, change of colour,such properties as flexibility, softness, compactness, the state of the face layer and so on. By means of the microscopic method state of preservation is estimated by studying the character and position of the collagen fibres in the derma section. The content of moisture in leather is estimated with reference to the weight of completely dry leather. Tests on water-solubility make it possible to judge about the degree of collagen decomposition.

The indications of the good preservation condition of archaeological leather are: a relatively high tensile strength, absence of putrefaction spots and light colour, flexibility and ductility, hardness, resiliency, the normal degree of parting of fibres, their length and orientation, a relatively high temperature index of the beginning of shrinkage, no signs of getting gelatinized when wetted with water.

The leather of poor and middle state of preservation is caracterised by the change of these properties. It is much darker, the darkening being caused by strong oxidation ("burning"). It is particularly seen on samples of dry leather that the darker the leather, the worse it is preserved. The tensile strength decreases considerably. When the samples of wet archaeological leather of poor condition are washed in water, they often disintegrate in the fingers. Dry leather under deformation or slight force turns into powder. The leather loses resiliency (often irreversibly), becomes horny, can warp. Its porosity diminishes. In the process of drying the fibres get compact and shrivel. In drying, the samples of wet archaeological leather show considerable shrinkage in area ana volume. The ability of fibres to be sticked together increases (the fibres are not parted). Separate bundles or whole areas of fibres are observed to get shorter and stick together. Fibre structures become more compact, the fibres get closer to each other, they change their orientation. The stability of derma to acids and alkalis (vinegar, soap) decreases. Swelling in water and wettability of hair (fur) considerably increases. The temperature of the beginning of collagen shrinkage under the actioh of hot water becomes lower. Leather in poor state gets gelatinized even under the action of cold water, whereas according to the standard techniques sheepskin begins to shrink at $+60^{o}$. The shrinkage temperature in well tanned leather is provided by strong links resisting the hydrolysis in water at high temperature. An irreversible change of the hide's protein is considered to take place in the process of tanning. The tanning ma- merials interact with the functional protein groups. These irreversible changes provide the stability of the proteins against alterations under the influence of external factors. To isolate the tanning materials from archaeological leather and to define their nature is an extremely difficult problem, often an unsolvable one.

Partial untanning appears to take place in archaeological leather. How is the link between the tanning materials and the functional protein groups destroyed? How do the techniques of leather dressing and tanning, the conditions in which it lay burried affect the rate of the untanning process? These questions have not been studied.

One of the old methods of leather conservation is wetting in salty water. Leather swells in a salt solution at I0 g/l concentration, at a higher concentration it becomes dehydrated and dries in. Dehydrating (desalting) properties are characteristic of sulphates and carbonates. The archaeological leather found in the Pazyryk burial mounds are strongly salted. Thin leather on burial horse masks (Altaj, Pazyryk, 4th-5th century B.C.) is entirely strewn with salt crystals (sulphates). The attempts to completely remove them failed. The leather is badly preserved, that is why it could not be subjected to water treatment. The salt was cleared away under the microscope by mechanical means. Note should be given to the idea, however, that the sulphates and carbonates might play the role of the conserving agents. By drying and dehydrating the leather, did not the salts prevent the development of putrefaction bacteria? Better preservation of archaeological leather is observed also under bronze plates and decorations. What is at the bottom of this? These questions call for attention and study.

The pH of environmental medium affects the preservation of leather as well. The least change of the dimensions (it means also swelling and shrinkage) is observed at pH 6-7.

Systematic treatment of archaeological leather findings began at the State Hermitage in the 50s when numerous findings from excavations in Pskov carried out by G.P. Grozdilov (details of footwear, bags, purses, leather balls, fragments of various leather objects, scraps of leather dating back to 9th-I5th centuries A.D.) were brought to the Department of primitive culture. All the articles were wet, of middle degree of preservation. Their conservation was carried out by consolidating them with the glycerol, polyvinyl alcohol and water mixture, according to the method suggested by the Hermitage head restorer N.A.Rumyantsev. The method proved reliable, as time showed it. Leather objects from Pskov which underwent conservation in I955-58 are being well preserved in normal museum conditions. The findings which did not go through conservation were practically destroyed: they became dry, warped, and in many cases disintegrated. It is to be noted, however, that at high humidity (over 70%) leather objects impregnated with glycerol and polyvinyl alcohol begin to suck in moisture, and if the conditions of high humidity become protracted, there is a danger for the leather to grow mouldy and rotten. In case when mould or "fat" coating and moisture appeared on the surface, the leather article was rubbed with wads wetted in ethyl alcohol, sometimes in the I-4% thymol solution in ethyl alcohol. Though being dark and fatty, the leather objects treated by this method preserved well their shape and size. The mixture can be easily washed out of the leather.

As it was established in our laboratory, archaeological leather findings excavated wet and in a satisfactory state must be kept wet before the laboratory treatment begins. We suggest that such findings be immediately put in polyethylene bags with thymol crystals in them to prevent the object from drying and growing mouldy. The bags should be hermetically sealed.

The laboratory treatment of such leather is carried out in two steps: washing and fat liqouring.

The state of preservation permitting (the leather is compact, possesses some flexibility), the object is immersed into a bath with a washing solution (water, alcohol, glycerol, thymol) at room temperature or warmed up to 30-35°C. The dirt, earth particles are washed away with soft brushes and are wiped off with fingers. The fingers control the softening of the leather, they smooth out the creases and wrinkles, feel the presence of stamping which is sometimes impossible to see under the dirt. This operation should be carried out with great precaution.

If the object is in a poor state, it should not be immerces into a bath, but is to be washed and cleaned with wads wetted in a washing solution and wrung out. Softened pieces of dirt are carefully removed with a scalpel and a brush, the article is only slightly wetted with the wads. The leather does not undergo impregnation with the washing solution, but is only a little moistened from the surface. Leather of poor condition possesses a high moisture capacity, sucking in the excess of moisture. It often disintegrates in the fingers.

Cleaned leather objects (most often they represent separate details, as the threads with which the object was sewed together got rotten) are dried with blotting paper napkins. Then they are placed between sheets of blotting paper and two sheets of plywood (or glass) and are subjected to semi-drying. In case when it is necessary to smooth out the article, some marble weights of various size are put on the plywood. In 2-3 days the slightly moist leather of good condition is spread out face down on a sheet of glass and is impregnated with neat's-foot oil with the help of a brush a few times till the oil continues to soak into leather. For drying it is put between sheets of filter paper and glass or plywood. If after drying the leather is not sufficiently flexible the impregnation with the oil is repeated. In cases when the shape of the object is complicated, the object is dried on some wooden supports (boot lasts, blocks), polyethylene bags with sand (filter paper and bandage packings are used); sometimes fine crubled cork is put into the article (purses, bags, balls).

In a number of cases fat liqouring of wet leather is carried out with lipodermliquor. The object is immersed into a bath with a slightly warmed water-lipodermliquor mixture (I:I) and is kept in it from 2-3 days to 2 weeks. The mixture is periodically warmed and agitated. The object is massaged with the fingers in the bath. The leather is taken out of the bath when the mixture becomes thick and dark. The paste lipodermliquor is used in industry for fat liqouring the fur skin of small animals. When diluted with water, it forms a stable fine emulsion. It contains sulphonated sperm oil, and it does not alter the leather tissue colour.

For fat liqouring in baths we also use the emulsion RK which is composed of the following components: stearin, lanolin, white mineral oil, cetyl alcohol, glycerol and triethanolamine (the emulsifying agent - less than 2%). The fat liqouring emulsion is produced by the industry as a cosmetic. The treatment is carried out in a bath as above (slight warming up to 30°C, massaging the leather with the fingers, keeping it in the bath from two days to two weeks). The drying of the object is carried out as described. As a result of such treatment (after final drying), the leather becomes so flexible that it is possible to perform all the restoration processes: smoothing out to preserve the shape of the article, glueing up, relining etc. If after the treatment with neat's-foot oil the leather becomes too fat and glues up badly, the excess of oil in the places of glueing is removed with a cotton-gauze wad wetted in white spirit.

The conservation of poorly preserved wet archaeological leather requires a special approach. Such leather irreversibly loses its compactness, flexibility, strength. The degradation of leather tissue is so great that it is impossible to preserve the article without a consolidating impregnation. As a matter of fact, what takes place during conservation is the filling of the crumbly degraded leather with a polymer. As a result, a new leather-like material, with new, relatively uniform, properties is formed. For this purpose an aqueous dispersion of copolymer VA-2EHA (vynyl acetate and 2-ethyl hexyl acrylate) is used. This copolymer is internally plasticised, transarent, possesses good adhesive properties, physically stable, chemically inert. It penetrates the leather tissue readily, non-toxic and convenient in work. In the process of impregnation the polymer plays the role of a filler, filling the interfibre space.

As a result of the impregnation with the copolymer dispersion, the degraded archaeological leather becomes strong and stable to temperature and humidity fluctuations. The impregnation is carried out from the reverse side with a brush. The concentration of the impregnating mixture depends on the friablility of the leather. The feature of wet archaeological leather treatment is that the consolidating impregnation with the dispersion is performed together with the emulsion fat liqouring and that both operations are done simultaneously. The fat liqouring emulsion is put on the object with a cotton-gauze wad directly after a layer of dispersion is spread on the surface with a brush. Both substances are thoroughly rubbed with the fingers into the thickness of the leather by massage-like motions. If it is difficult to attain a through permeating of the substances, the treatment is undertaken from both sides of the article.

Wet archaeological leather of middle and poor preservation can exfoliate, For example, the details of a boot consisted of two or several layers. Careful examination under the microscope showed that it was one and the same detail which got exfoliated like birch bark. In such cases it was convenient to carry out the treatment of each layer separately. Then they were glued up together.

To sum up, wet leather in any state of preservation must, first of all, be brought from the expedition to the laboratory damp as it was in the earth, not letting it get mouldy or dry. Then, in the laboratory, the finding is carefully examined visually, necessary analyses are made (the presence of paint, remains of textile fibres, metallic and other dedorations, remnants of hair if it is fur, etc.). The state of preservation, strength, compactness, flexibility, tensility, the state of collagen fibres, water-solubility (gelatinization) etc are defined. The object is weighed, measured, made a drawing of and, the state of preservation permitting, photographed. All the operations preceding conservation should be performed with much care and as quick as possible.

Dry leather of good condition sometimes needs only cleaning, assorting the details, glueing up, relining and supplementing the losses which are- as a rule, of mechanical origin. Very thin, dry archaeological leather of light colour is found to be successfully conserved by Zoltan Shalai method (Hungary): impregnation with a mixture composed of tertiary butyl alcohol, neat's-foot oil, cetyl alcohol, with preliminary wetting in water with glycerol.

The sleeve of the leather lining from the so called "rose-coloured" garment found in the burial tomb place

Moshchevaya balka (8th century A.D., Northern Caucasus) made of several scores of small pieces of thin leather, was crumpled, warped, had many losses and putrefaction spots. After treatment according to Zoltan Shalai method it straightened out, became lighter and much more flexible. It should be noted that the leather of this article was in a state of satisfactory preservation, though it required much restoration work.

Dry archaeological leather of middle and poor condition, as well as wet archaeological leather of similar state of preservation, needs complex conservation, that is, both fat liqouring and consolidating impregnation simultaneously. The treatment procedures for dry archaeological leather are nearly the same as used in wet leather treatment, but some features characteristic of the conservation of dry leather should be given. Cleaning of such objects is carried out mostly by mechanical means. Dirt, insect envelopes, rodent excrements, dry pieces of earth, clay etc., are removed with a scalpel and brushes. When fur is cleaned, it is necessary to check up the state of the hair and the epidermis layer. In case when the hair came off the derma, and the epidermis layer is destroyed, the treatment begins with the consolidation of the fur which came off the skin. The consolidation is performed with VA-2EHA dispersion using a brush and a comb. Then dirt is removed from the fur and the derma by mechanical means. Sometimes the object is also cleaned with the help of a vacuum-cleaner through 2-3 layers of moistened cotton-gauze.

Leather with salt crystals formed on the surface is cleaned using a magnifying glass or a microscope, in particular if there are traces of paint, resin, stamping, applique, etc. When cleaning dry leather, particles of materials preserved on the surface (paint, metal oxides, resin, chalk etc.) should be examined, as these may serve as indications of what the object was intended for and how it was used. All sorts of dints, holes, marks and dents should also be paid attention to, because it is not always that they represent mechanical damage. Breaks at the edges, holes from old stitches, dents can help to restore the correct shape of the article, as well as the stamping relief and the applique work ornament. All these data, obtained as a result of careful examination of the monument before the procedures of cleaning and conservation begin, enables the restorers to distinguish traces of biochemical and physical damage from those of functional wear and treatment with some tool. They can also give some extremely important information for solving many problems of complex scientific study of the archaeological material.

Archaeological objects of dry, thin, nearly horn-like leather are, as a rule, found in a very warped state, their shape being changed beyond recognition. To flatten out such articles and to return them their original shape is an extremely difficult task. Impregnation with the copolymer dispersion sometimes helps to flatten out the deformed leather objects. During the impregnation andfat liqouring procedures which are carried out simultaneously the article is smoothed out, with much care taken, sometimes it is simply moulded with the fingers. The procedure is very delicate, it should be performed properly, gently and gradually. The drying in such cases must be slow, the object must be firmly fixed on some support till it gets completely dry and stabilized in shape. A child's shoe from Moshchevaya balka (8th century A.D., Northern Caucasus) was treated in this way. The shoe was placed on a bag with sand for drying. The bag had the form of the shoe and was put into the shoe like a last. Some blotting paper paddings were put between the bag and the shoe, the shoe was tightly bandaged to the "last" from the top.

Archaeological leather findings in a very poor state require a special approach. Most often such objects are deformed irreversibly. The leather breaks, disintegrates into fragments under the slightest mechanical force, is often turned into powder. No fat liqouring and impregnation in such cases are possible, but sometimes we manage to preserve the finding. Thus, for example, a leather quiver from the Oglakhty burial place (Ist century B.C. - Ist century A.D., Khakass Autonomous Region) was relined on a VA-2EHA copolymer film produced of the thick dispersion of the copolymer. Relining on a polymer film on tulle, gossamer, cambric or canvas solves the problem of preserving the finding in the state it reaches us.

For glueing up the fragments and relining we also use, besides the VA-2EHA copolymer dispersion, methylol - polyamid glue (PFE-2/IO), and some other glues. The losses are supplemented with canvas or cambric, if the leather is very thin. The relining cloth is glued up to the edge of the article from the reverse side. From the face side the cloth is put in several layers. The supplements are cut out by using patterns which are traced out on a thin polyethylene film. The upper layer of the supplements is tinged. Small losses are filled with putty made of leather powder obtained after tne pumucing of dressed leather, or with leather powder received from archaeological leather rubbed into powder.

All archaeological leather articles treated in our laboratory can be kept in usual museum conditions (at I8°C ±2°C and relative humidity 55% ± 5%).

In our work we keep to the following basic rules:

I. All objects before treatment must be thoroughly examined, described and fixed.

2. The materials used when interacting with those of the object to be restored must not provoke any undesirable after-effects.

3. The means and methods of treatment must fit the object to the utmost.

4. The approach to archaeological findings must be differential, as each of them is unique and possesses its own inimitable attributes and properties.

We try as much as possible to unite different procedures of treatment. Materials used are harmless for people and convenient in work. All the restoration materials are used in full, there is no waste. The classification of archaeological findings we suggest (with a strict individual approach to each object having in mind) helps to correctly decide and technologically carry out the conservation method.

81/19/3

DAMAGE OF PARCHMENT AND LEATHER CAUSED BY MICROBES

L.I.Voronina, O.N.Nazarova, U.P.Petushkova
and N.L.Rebrikova

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Conservation of Leathercraft
and Related Objects

DAMAGE OF PARCHMENT AND LEATHER CAUSED BY MICROBES

L.I.Voronina, O.N.Nazarova, U.P.Petushkova and N.L. Rebrikova

WCNILKR
10 Khrestyanskaya pl.
109172 Moscow
USSR

Owing to a number of their peculiar properties (the presence of combination of various organic and mineral substanus, high hygroscopicity), leather and parchment are damaged by microorganisms easily enough. Damage of these materials, caused by microbes often takes place also under the conditions of their storage in museums. In spite of this, the problem dealing with microorganisms growing on leather and parchment has been scantily explored.

The aim of this paper is the study of microorganisms damaging leather and parchment, the investigation of influence exerted on their growth by the environment, and finding methods of desinfecting the damaged parchment.

Microorganisms and the nature of damage caused by them

To reveal bacteria, examination was carried out of many parchment manuscripts and leather bindings in books kept in libraries, archives and museums situated in various geographic zones of the Soviet Union (Moscow, the Moscow region, Georgia, the Ukraine, Lithuania, Latvia, Estonia). The objects examined had different origin, age, treatment, state of preservation, conditions of storage. The most characteristic kinds of damage were examined, such as deformation, brittleness and thinness of sheets resulting even in the destruction of their wholeness, various pigment formations, white films, decoloration of the text.

A great number of bacteria was isolated from the damaged sections of the parchment. For example, 30 strains were revealed in parchment charters dating XIV-XVIII centuries. 6 strains were isolated from a single sheet of a Greek manuscript of XIII century. Examination under the microscope showed that the bacteria microflora of the materials under study was represented mainly by spore-forming bacteria. Judging by their morphological properties and the form of their colonies most of them can be regarded as Bacillus. Species of this genus were isolated as a rule from the deep layers of the parchment and grew on the parchment agar. Nonspore-forming bacteria, cocci of various size were found along with bacilli. Two strains of bacteria containing pigments of yellow and red colour were isolated from one of the parchment manuscripts. Bacteria which form pigment giving the medium pink colouring were also isolated from the damaged parchment. Bacteria belonging to Sarcina genus were discovered in the coloured layer of miniatures on a XVIII century parchment.

To find the degree of contamination in various parchments and leather the authors isolated and recorded the total number of viable bacteria in samples, using Kox's cup method. It was shown that the degree of contamination in the studied materials varied widely: there are 10^1-10^6 bacteria cells in 1 gr. of the substrate (Table 1). Thus, the microflora contaminating ancient parchments and leather is represented by various bacteria. Among them the most numerous are ammonifying bacteria of the Bacillus genus, which can destroy proteins - the main components of the materials under study. There is no doubt that the species of microorganisms taking part in the destruction of ancient parchments in the long period of their existence are much more numerous. Even when skins are dressed in the process of making parchment and leather, bacteria can penetrate into their deep layers and remain there in a nonactive state for a long time; when optimal physico-chemical conditions (humidity, temperature, pH) are created in the medium, these bacteria become active again.

Mycromicets were isolated from the contaminated manuscripts and charters, from leather in book-covers and from leather found in archeological excavations. On contaminated parchment and leather fungi form films of grey, orange, black, brown and white colour. In some cases there were coloured spots under the films in the parchment. There were spots of various hues due to the contamination by fungi in leather of dark colour. Among the fungi that were isolated there were specimens of Zygomycetes, Ascomycetes and, in most cases specimens of Deuteromycetes.

<u>The study of environmental conditions that prevent the growth of mould fungi on leather and parchment</u>

The most important problem in the fight against microorganisms damoging antiquities and works of art is to devise prophylactic measures based on science. Many factors influence the activity of microorganisms (humidity, temperature, sources of nutrition, pH of the medium, light, pressure etc.); changing them can be used for controlling the growth of microorganisms.

The main factor regulating the growth of microorganisms in museums is humidity. Microorganisms do not possess any systems capable of satisfying their need of water at the expense of their metabolism; therefore they depend to the highest degree on the moisture contained in the substrate. The presence of moisture depends directly on the level of relative humidity of air. Date show that the maximum level of relative humidity for growth of mycelium fungi is 70%.

Leather and parchment possess high hygroscopicity and as compared to other materials, respond particularly strongly to changes in the humidity of air. Excessive dryness results in the destruction of these materials, and the level of humidity needed to make them elastic (68-70%) threatens to produce growth of mould fungi.

A series of experiments were conducted on parchment and leather to find the optimal temperature and humidity parameters. For this purpose specimens of ancient and modern parchment, as well as those of vegetable tanned leather were infected with fungus spores. Before this the specimens were sterilized by rays (2.5 Mrd. dose). The specimens that were infected were kept in chambers under conditions of constant humidity and temperature. It was found that lowering the humidity level results in lowering the speed of growth in mycelium fungi on materials containing collagen, and this process acts on spore bearing. At low humidity levels the growth of some species of Penicillium which bear many spores under ordinary conditions, took place without completion of the life cycle only in the vegetation phase. It was found that when fungi grew on parchment, their stability relative to one factor, namely, low humidity, was higher when the other factor (temperature) was nearly optimal (Table 2).

Fungi isolated from leather and parchment were studied, to reveal xerophite strains (organisms capable of growth in materials with low moisture content). Media with high osmotic potential were employed for this purpose. In the course of the experiments the growth of fungi on media having different osmotic potential was compared with their growth on leather and parchment specimens. When constant humidity dropped from 100 to 95%, the intensity of fungi growth on the specimens diminished; xerophites grew with the same intensity, and hydrophite strains did not grow at all when the humidity level was 95%.

On account of this phenomenon it is recommended to use xerophite strains in experiments aimed at revealing such humidity levels that are safe for keeping leather and parchment.

In our experiments xerophite isolated made up 50% of all the isolated strains, and this fact suggests the possibility of selecting xerophite forms in closed echosystems in museum funds, archive depositories and libraries.

Disinfecting and straightening of parchment damaged by microorganisms

Growth of microorganisms on parchment is accompanied as a rule by various physico-chemical processes making sheets rigid, brittle and deformed. Therefore it became necessary to find a method of desinfection which eliminated any deformation of parchment.

The authors of the published data suggested the use of thymol, formaldehyde, trichloromethyl, p-chlorine-m-chresol, ethylene oxide to desinfect parchment. However, all these methods are either not effective enough, or they change the parchment properties to a great degree.

In our work we used catamin AB as a desinfectant. Its choice was not incidental. It had already been used to disinfect paintings and museum fabrics. It was found that catamin AB is an effective means of combating microorganisms (micromycets and bacteria). It dissolves easily in water, alcohol and a number of other organic solvents employed in restoration practice. It has a neutral or nearly neutral reaction of the medium, it is odorless and colourless in the working solution. These properties fully satisfy the requirements that are necessary in work with disinfectants.

The experiments were carried out on models consisting of fragments of modern parchment. The samples were infected with the suspension of bacteria and fungi spores. Bacteria and fungi isolated from contaminated parchments were used as test organisms. The infected samples were placed under conditions that were optimal for the microorganisms, and then allowed to grow for a month. After that the samples were disinfected. The 3% aqueous-alcohol solution of catamin AB was employed as a disinfectant. The proportion of water and alcohol was 1:3 respectively. This compound was found experimentally to be the most favourable for parchment.

Three methods for disinfection techniques proved to be the most effective:

1. Immersion of parchment in a disenfectant solution for 5 min.

2. Application of the solution to the parchment surface with a brush.

3. Insertion of the parchment between sheets of filter-paper soaked in the disinfectant solution for 30-40 min.

In all three cases, after treatment the parchment was put to dry under a press for 3 days. The efficiency of disinfection was checked by placing the treated samples on nutrient media.

It was found that in all three cases the experimenters attained complete disinfection and avoided parchment deformation. Moreover, it was found that after the treatment the parchment became softer and more flexible.

A number of analogous experiments on ancient parchment confirmed the conclusions made by the authors.

Only the second and the third methods can be recommended for practical use. The second method is intended for particular cases (for example, when only a small part of the sheet is to be treated), and is chosen by the restorer according to the problem he wishes to solve. The third method is employed as a somewhat modernized technique of distant moistening, where a disinfectant solution is used instead of water.

To determine the action of disinfection on the parchment properties, its physico-mechanical and physico-chemical properties were studied before and after the treatment. The physico-mechanical properties were determined by the safety coefficients in stretching, by ultimate elongation, hardness and elasticity of the material.

The physico-chemical properties were determined by the coefficients of hygroscopicity, moisture outflow and acidity (Tables 3 and 4). Table 3 shows the experimental results in the form of proportion between the figures obtained before and after the treatment. Parchment samples treated with the solvent were studied as controls. It should be noted that because of its anisotropy it was difficult to evaluate the degree to which the disinfectant acted on the physico-mechanical properties of the parchment. The structural irregularity of collagen produces difference in the mechanical strength of parchment samples. Nevertheless the data obtained enable us to say that catamin AB produces no harmful action on the chemical and physical properties of parchment.

Table 1

Quantities of bacteria isolated from ancient parchment

Object of research	Place of storage	Number of strains	Total quantity of bacteria in 1 gr. of substrate
Leather (XI century book-cover)	Moscow	3 (Bacillus)	$5.9x10^3$
Leather (	Moscow	5	$2.5x10^3$
Leather (XVIII century book-cover)	Novgorod	2 (Bacillus)	$1.0x10^3$
Parchment (XIV-XV centuries manuscript)	Tartu	4 (Bacillus)	$2.4x10^2$
Parchment (XIV-XV centuries manuscript)	Tartu	2 (Bacillus)	$4.0x10^2$
Parchment (XV century manuscript)	Tartu	1 (Bacillus)	$1.8x10^1$
Book-cover parchment (treatise of the year 1598)	Tartu	3 (Bacillus and sporeless)	$4.2x10^4$
Parchment (Latin Gradual of the XVI c.)	Lwov	7	$1.4x10^6$
Parchment (Psalm-Book of the year 1575)	Lwov	3	$3.4x10^4 - 1.3x10^6$
Parchment (XV c. Bible)	Lwov	3 (1-Bacillus)	$1.9x10^5$
Parchment (Antiphonary of XVI c.)	Lwov	9 (2-Bacillus)	$1.0x10^4 - 5.0x10^5$
Book-cover parchment	Lwov	3 (1-Bacillus)	$9.4x10^4 - 1.8x10^5$

Note: The quantity of strains and total amount of bacteria were found on MPA medium (beef-pepton agar).

Table 2

Growth of Basipetospora on parchment samples at various levels of moisture and temperature

Temperature	Moisture	Kind of parchment	Incubation time for twenty four hours														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
24°C	100	modern	–	–	–	+											
		ancient	–	–	–	+											
	98	modern	–	–	–	+											
		ancient	–	–	–	+											
	88	modern	–	–	–	–	–	–									
		ancient	–	–	–	–	–	–									
	83	modern	–	–	–	–	–	–									
		ancient	–	–	–	–	–	–									
	75	No growth was observed for 60 days															
30°C	100	modern	–	–	–	+											
		ancient	–	–	–	+											
	98	modern	–	–	–	+											
		ancient	–	–	–	+											
	88	modern	–	–	–	–	–	–									
		ancient	–	–	–	–	+										
	83	modern	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
		ancient	–	–	–	–	–	–	–	–	–	–	–	–	+		
	75	No growth was observed for 60 days															+

+ The beginning of visual growth of fungus.

Table 3

Effect of disinfection by catamin AB on the physico-mechanical and physico-chemical properties of parchment

Treatment	$\frac{P_1}{P_0}$	$\frac{\sigma_1}{\sigma_0}$	$\frac{\Delta L_1}{\Delta L_0}$	$\frac{H_1}{H_0}$	$\frac{Hr_1}{Hr_0}$	$\frac{E_1}{E_0}$	Hg_1/Hg_0 Parchment New	Hg_1/Hg_0 Parchment Ancient	W_1/W_0 Parchment New	W_1/W_0 Parchment Ancient
Distant moistening with disinfectant solution	0.9	0.9	0.5	1.3	1.2	1.0	1.0	1.4	1.1	1.0
Distant moistening with solvent	1.1	1.3	0.8	1.3	1.5	1.0	1.0	1.2	1.0	1.0
Application of disinfectant solution with a brush	1.0	1.1	1.0	0.8	1.0	1.0	1.1	1.3	1.0	1.0
Application of solvent with a brush	0.8	0.9	0.9	1.1	1.2	1.0	1.1	1.2	1.0	0.8

Note: P - load; σ - limit of strength; L - relative elongation; H - hardness; Hr - relative hardness; E - elasticity; Hg - hygroscopicity; W - moisture absorption. Index $_0$ and $_1$ represent experimental results before and after corresponting treatment.

81/19/4

CONSERVATION OF CASKETS AND FURNITURE COVERED WITH LEATHER

P. Hallebeek and H.A.B. van Soest

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Conservation of Leathercraft and Related Objects

CONSERVATION OF CASKETS AND FURNITURE COVERED WITH LEATHER

P. Hallebeek and H.A.B. van Soest

Central Research Laboratory for Objects of Art and Science
Gabriël Metsustraat 8
1071 EA Amsterdam
The Netherlands

abstract:
Moisture and oil contents in vegetable tanned leather are discussed.
The determination of this balance and the correction of a disturbed balance are explained.
Cleaning formulations and proper dressings for leather are proposed.

Part I.Practical approach.

In the following outline valuable caskets,cases and other furniture pieces,covered with vegetable tanned leather,free of any finishing coating are discussed in terms of the premeditated conserving action that led to their salvation.
The care of leather used to cover such objects or as upholstery,requires the presence of well dosed amounts of both oil and moisture in that leather.
As however in such cases only the grain side of the leather is within reach-and the grain side is usually less accessible than the flesh side-it is extremely difficult to attain an equally well distributed fatty matter throughout the leather.
One complication that often occurs during oiling of leather,is the depression of the moisture content of the leather,a result from interjecting more oil than the subtle balance between oil and moisture could actually tolerate.
With view to better maintenance,old leather-in which this balance is often gravely disturbed-is normally treated with excess oil.The consequence is that the water is driven out of the leather by the oil and that the leather becomes thereby desiccated and thus the reverse is attained of what had been intended as a preservation act.
But even if the right amount of oil is used but the oil is nonetheless not evenly distributed in the leather texture,the effect of the oiling cannot be rightly considered to be a preserving one.
The capacity of oiled leather to absorb moisture and the influence of changes in oil content on the already present moisture in the leather,are discussed at length in part II.

Determination of the oil content.

With oil content is meant here all fatty substances which are not chemically fixed to the leather.
This kind of oil,but not the chemically fixed part,can be extracted from the leather and then measured.
The optimal oil content in leather should be about 5% by weight.
If the oil content is found to be less then 5% the lacking oil portion must be added,so that the 5% oil content is secured.

Supplement of the required oil content.
The oil content of a particular 17th century leather fragment (size 34X26 cm,0,4 mm.thickness and a weight of 70 grams) was found to be 1,5-2% and it was estimated that about 2 grams of oil must be added in order to lift the oil content of the fragment to 5%.
In other words,if an emulsion,containing 12% oil is used in this example,then 17 grams of the emulsion must be applied to the fragment in order to adjust its oil content to the desired 5%.
The calculations are given here with the purpose of demonstrating that for real conservation of leather, in practice only sparing amounts of oil are necessary.
On the other hand excessive oiling could not be expected to do any good at all.It will however dry out the leather.

Equal distribution of the oil.
There are four ways to bring oil into the leather.
1.Pure oil is massaged into the leather.
2.Emulsified oil is applied to the leather whereby the water included in the emulsion does at the same time the service of swelling the leather fibres,thus opening interfibrous paths,along which then the oil penetrates the leather.
3.Oil diluted with an organic solvent is applied to the leather in the same manner as the emulsified oil mentioned above.
The rate of penetration is however slow,due to the matted unswollen leather.
4.A mixture of water,oil and organic solvents is applied to the leather;the purpose is to profit from the advantages of the already cited three previous methods.
The choice from one of these oiling operations depends on the state of the leather that needs dressing.
For instance a fine leatherwork should never be treated with an emulsion of less than 12% oil.
Otherwise,to much moisture will come into the leather in the process of continuous adding of emulsified oil in order to reach the 5% level.
On the contrary,gilded leather-of which only the flesh side is accessible to dressings-is usually treated with an emulsion of about 7% oil.
The aim in this instance is to use the larger quantity of available water,not only for the swelling of the leather,but also to make it soft and to flatten it.

Cuir bouilli is best impregnated with oil dissolved in organic solvents.
Hexane,white spirits and iso-propyl alcohol are the solvents which are used most for this purpose.Chosing one of them-if this seems necessary-depends again on the kind of leather and its state of preservation.
Preparation of dressings is based on the necessity not only to put oil into the leather but also to disperse it evenly.
Solvents which evaporate quickly obstruct such regular spreading of the oil,as the solvent that still remains behind the evaporation front,exactly because of the evaporation,is continuously enriched in oil.In its turn this enriched oil solution is drawn-again due to the evaporation-from the interior of the leather.
The result is that the surface pores are plugged with oil (where it is least needed)awhile the inner part of the leather is deprived of lubricant.
The dressings which have been found to be of practical merit are discussed in part II.

Preadjustment of the leather.

1.Deacidification.

Prior to oiling,the leather is subjected to an acidity test.If the measurement indicates values of less than pH 3 , fumigation with ammonia is considered to be a necessity.The leather is put in a closed space next to a vessel containing a 15% solution of ammonia,and left there for about 15 minutes.Through ammonia fumigation the pH of the leather is raised to values of above pH 3 .
If oil emulsion is to be used after fumigation,several days should be allowed to pass,as otherwise the still not evaporated excess of ammonia and the water from the applied emulsion will render the leather dark brown.

2.Cleaning.

Oil,wax,dirt,dust which have been accumulated on the grain side,on the flesh side,or on both sides of the old leather,hinder the passage of dressings and must be removed before oiling.
This is most effectively done with a cleaning fluid prepared as follows:
to 1 liter of distilled water are added:1 gram of carboxymethylcellulose(natrosol 250 HHR,manufacturer: Hercules)20 ml.of neutral soap(treopal N100,manufacturer: Hoechst).
The mixture is shaken vigorously and left to rest for one day in order to allow the carboxymethylcellulose to swell.

Then 10 parts of this mixture are poured-dropwise and under constant stirring-in 100 parts of trichlorotrifluoroethane(manufacturer: I.C.I.).
id.trichlorotrifluoroethane enters the human body through the skin or by inhaling.It is a depressant for the nervous system.There must be adequate ventilation during use and plastic gloves should be weared.

Frequency of oiling.

Determination of the fat content in old leather indicates whether it needs oiling again.Deficiency(less than 5% fatty matter)should be,by all means,eliminated through new oiling.But repeatedly oiling without any evidence of such deficiency is useless as an assistence to the safeguarding of the leather.

Part II.Comparative study on some conservation materials for leather.

1.Introduction.

In this part of our paper we will present the results of the first chapter of our research program on leather,in all its applications.
The intention of this program is to make a comparison between a range of products we have been using up until now for the conservation of mainly gilded leather.
In this respect are the most important properties of this products their penetreting capacity and the influence the have on the uptake and evaporation of moisture in the leather depending on the changes in atmospheric conditions.

2.1.Used emulsions and fat containing solutions.

A.Emulsion o/w.Composition :
neatsfoot oil:5 cc.castor oil:5 cc.turkish red oil:5 cc.
sorbitol:10 grams.emulsifier:15 cc.(arkopal,Hoechst).
ammonia:20 cc.(15%).water:300 cc.
B.Bodymilk:Cheseborough,fat content:5%,w/o emulsion.
C.Pliantine:(B.M.L.),fat content:25%,solvent:hexane.
D.Emulsion o/w.Composition:
neatsfoot oil:5 cc.castor oil:5 cc.turkish red oil:5 cc.
glycerine:25 cc.emulsifier:15 cc.(arkopal,Hoechst).
ammonia:20 cc.(15%).water:300 cc.
E.Babylotion:Boots,fat content:10%,o/w emulsion.
F.Bodymilk:Nivea,fat content:5%,o/w emulsion.

2.2. Description of the samples.

For our tests we have chosen gilded leather from the 17, 18 and 19 century and new leather,calfskin,vegetably tanned.
Dimensions of the samples: 10X10 cm.
At first we determined the fat content of each sample without any treatment and according to these values we applied to six samples of each period the required quantity of product depending on the weight of the sample to bring the average fat content at a level of 5%.
An exception was made for the new leather.
The fat was applied on the flesh side of the leather by means of a medium size brush.
After this treatment the samples were stored for about six weeks,according to previous investigations,at 20°C and 50%rh.After this period the leather is expected to be in balance and no more migration effects are taking place.
Then the samples are each divided in two parts,one part for moisture determination and the second part is split on the "skiving machine"in three horizontal layers: the grain side,the corium(middle) and corium base or flesh side.Each of these layers is used for determination of the fat content.

2.3. Methods.

For the determination of the moisture content we followed the prescription as stated in the book of A.L.C.A.methods nr.B3.Essentially this method consists in the weighing of the sample,drying in a electric oven for 3 hours at a temperature of 99°C and again weighing after cooling.
From the difference in weight before and after drying the moisture content can be calculated.
The disadvantage of this method is that no distinction is made between the two possible ways in which the moisture in the samples is present,namely in the capillaries between the fibres and chemically bound to the proteins of the fibres,from which the second possibility is of more interest than the first one because the quantity of water bound to the fibres gives an indication about the condition of the leather and the possibility to raise this percentage by means of the applied oil containing products.
An other method which makes it possible to distinquish between the two forms of water in the leather is to use different environments for the samples with changing relative humidities and constant temperature,because at a relative humidity of 45% and a temperature of 21°C the leather is loosing its capillary water.

For the determination of the fat content we followed A.L.C.A.nr.B4.
This is essentially a soxhlet extraction method.
The fats and oils in the leather are dissolved by means of a solvent.Sample and solvent are kept separate.In this way it is possible to weigh the fat residue after evaporation of the solvent.
After a comparison of different possible solvents like chloroform,petroleum-ether,methylene chloride and butanol we choose for methylene chloride.
In this case it is possible to extract almost all the free fats and oils from the leather.
By using this method we can only determine the free fats and oils in the leather,because the percentage of fat bound to the fibres is not extractable by means of a solvent.
At the moment there is no known method,chemically or physically to determine this percentage.

3.Explanation of the tables.
The characters A to G are referring to part 2.1 where the used products are mentioned.
The results are given in percentages by weight with an inaccuracy of 0,5%.
By comparing the figures for the fat content in three layers of one sample one can determine which product is giving best penetration and at the same time even distribution.
For the moisture content it is most important that the percentage is not going down compared with the untreated sample and especially not driven away from the middle.
From the tables it can be seen which types of emulsions are giving best results for leather samples from different periods.
These are:
for 17 century leather:B,D,E,F.
for 18 century leather:E,D,F.
for 19 century leather:E,F.
for new leather :C,D,E,F.
As a general conclusion one can say that for all types of examined leather the products E and F are giving best results.
So at present we are developing:
1.An emulsion of the o/w type,which contains a non-ionic emulsifier.

Results.

Distribution of fat and moisture in the horizontal divisions.

Table I

17^{th} Century Leather

product	grain		middle		flesh		result	
	fat	water	fat	water	fat	water	fat	water
un-treated	1,8	8,8	1,4	11,5	2,5	11,6	reference	
A	2,3	11,0	1,4	12,0	4,5	10,8	-	+
B	5,4	8,5	1,3	11,5	3,0	10,6	++	+
C	11,9	8,8	7,3	10,4	10,4	10,6	-	-
D	6,3	10,4	1,8	12,5	10,2	11,0	+	+
E	1,8	9,1	2,5	11,4	3,6	11,7	+	+
F	4,3	11,8	1,8	13,8	12,5	10,8	++	++

Table II

18^{th} Century Leather

product	grain		middle		flesh		result	
	fat	water	fat	water	fat	water	fat	water
un-treated	1,6	10,5	0,9	12,9	1,6	12,0	reference	
A	0,8	12,4	0,7	12,9	5,5	10,9	-	+
B	1,0	11,8	0,4	13,0	4,1	11,5	-	+
C	6,5	10,6	7,2	11,2	15,8	10,5	-	-
D	5,2	10,3	2,9	12,8	8,3	11,0	++	+
E	4,8	11,0	3,7	10,8	5,6	10,0	++	+
F	1,8	11,8	2,4	13,1	6,3	11,3	+	++

Results.

Distribution of fat and moisture in the horizontal divisions.

Table III

19th Century Leather

product	grain		middle		flesh		result	
	fat	water	fat	water	fat	water	fat	water
un-treated	1,1	8,9	3,1	11,2	1,6	9,8	reference	
A	0,4	9,2	0,5	10,9	2,1	10,6	--	-
B	0,6	10,6	1,4	11,1	3,5	10,6	--	+
C	3,0	8,2	5,6	10,7	13,5	9,3	-	-
D	3,5	8,5	3,1	10,2	7,6	8,8	+	-
E	2,9	10,8	1,6	12,8	2,6	12,2	+	++
F	3,7	8,7	3,4	11,1	2,8	10,6	++	+

Table IV

New Leather

product	grain		middle		flesh		result	
	fat	water	fat	water	fat	water	fat	water
un-treated	9,1	9,8	6,8	10,7	7,4	9,8	reference	
A	11,3	8,6	6,9	9,9	6,7	8,3	+	-
B	10,9	9,3	9,9	10,4	11,6	9,3	+	-
C	13,1	8,7	8,3	10,8	11,8	9,9	++	+
D	11,5	8,5	6,5	10,9	10,4	10,0	++	+
E	11,6	8,2	9,9	11,4	7,8	10,1	++	++
F	12,8	8,4	8,8	10,0	12,3	7,9	++	+

The fats and oils we want to put into the leather,such as neatsfoot oil,castor oil and lanoline.
A buffer to keep the pH of the leather within the desired limits.
2.A three fase emulsion of the o/w type which contains at the same time water and a organic solvent,which evaporates rather slowly in order to get a better distribution of the fat.
3.A fat containing solution made up from the same oils and fat as the emulsions and a organic solvent.

References.

1.Technical Methods of the A.L.C.A.(American Leather Chemists Association,1957).
2.Tardel,W."Das Leder"3,1979,33.
3.Belaya "Restauration and Conservation of the leather Bindings of old Books".I.C.O.M.Madrid,1972.
4.Belaya "Konservierung Ledereinbände".I.A.D.A.3,1972,295.
5.Hejcl,F.;Hanzlova,J."Maltechnik".1,1981,44.
6.Haines,B."The Conservation of Library and Archive Materials and the Graphic Arts".Conference Cambridge 1980.
7.Stambolov,T."Manufacture,Deterioration and Preservation of Leather".I.C.O.M.Paris,1969.

EASEL PAINTINGS

Coordinator : H. Kühn (FRG)

Assistant coordinator: S. Delbourgo (France)

Members : A. Belcour (France)
F.S.Bergeon (France)
J.C.Cellier (France)
M. Dauchot-Dehon (Belgium)
J.D.Hourrière (France)
A. Lautraite (France)
A.S.Lepage (France)
G. Lepavec (France)
G. Mâle (France)
E. Martin (France)
L. Masschelein-Kleiner (Belgium)
F. Mairinger (Austria)
F. Preusser (FRG)
E.-L.Richter (FRG)
M. Stefanaggi (France)
R. White (UK)
J. Winter (USA)

Programme 1978-1981

1. Les effets des solvants sur les couches picturales (Dauchot-Dehon).
2. Le blanchissement de certaines zones de la couche colorée (Mâle, Bergeon, Martin, Belcour, Lepage, Lepavec, Cellier e.a).
3. Analyse des liants (Masschelein-Kleiner).
4. Investigation of the painting technique of Rubens (Preusser).
5. Identification and dating of media by means of differential thermal analysis (Preusser).
6. Etude colorimetrique du vieillissement des couleurs utilisées en restauration (Stefanaggi).
7. Investigation of Medieval German painting and polychromed sculpture (Richter).
8. Analysis of paint media (drying oils, natural resins and waxes)(White).
9. Technical studies on East Asian paintings (Winter).
10. Investigation of composition and alteration of green pigments (Mairinger).

81/20/1

A TECHNICAL EXAMINATION OF THE PAINTINGS PRESENTED FOR THE CURLANDESE PRIZE COMPETITIONS, FINE ARTS ACADEMY OF BOLOGNA, 1785-1870

Mirella Simonetti, Silvia Baroni, Marco Sarti and Camillo Tarozzi

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Easel Paintings

A TECHNICAL EXAMINATION OF THE PAINTINGS PRESENTED FOR THE CURLANDESE PRIZE COMPETITIONS, FINE ARTS ACADEMY OF BOLOGNA, 1785-1870

Mirella Simonetti, Silvia Baroni, Marco Sarti and Camillo Tarozzi

Via Saragozza 18
Bologna
Italy

Abstract:

The authors examine a very particular time in the history of the teaching of art technique, the foundation of the academies of art in Italy in the early 19th century, and focus on the technical results obtained by the students of these academies, as exemplified by paintings presented for the Curlandese Prize Competitions of the Academy in Bologna. Special emphasis is placed on the technique of varnishing, on the origin of this practice, and on its significance. The conclusions are centered on the importance for the conservator of evaluating the function of the original varnishes before selecting the method of restoration to be applied.

The inauguration of the Academy of Fine Arts represents for the history of 18th and 19th century Italian art a revolution in the cultural organization of the visual arts and the beginnings of a new method of passing on artistic knowledge from generation to generation.

The ancient master-apprentist relationship is transformed, allowing the student to profit from multiple influences offered him in the institutional setting. Technically speaking, whereas the Renaissance student learned from observation of the teachings of his master, and therefore obtained a kind of practical knowledge of the techniques of painting, in the academic structure he is exposed to the most varied experiences. The technique that up until the end of the 17th century were kept as secrets inside the workshops, and passed on in manuscripts from master to student, become arguments of public discussion and debate in the pages of widely circulated journals printed by the newly formed cultural industry. The reprinting of the antique writings and formulas testify to the growth of interest in the classical teachings among a public of young artists that included a large group of dilettants.

The Academy became the principal institution dedicated to the conservation both of the paintings themselves and of the knowledge of painting technique. In the art galleries and in the art schools, art education was no longer based on the pedantic repetition of teachings but on a continual evolution in the use of different practices.

Copying the works of old masters which were now available in the art gallery replaced the formerly essential "excursion to Rome" undertaken by the great artists of the past and offered an immediate contrast of styles and techniques. This inevitably led to an appreciation of the differences in the use of materials, of the meaning of the various technical innovations, and of the way different traditions were implemented and combined.

In commenting upon the tonal implications of this practice, D. Selvatico wrote in 1856:

> Almost all artists up until, we might say, yesterday, were able to produce, by long study, diligent copies of Titian, of Bonifacio, and of the other old masters who were considered as among the best in the use of color and transparancy; but (we might ask ourselves if) they were also able to imitate the tonality and, above all, the transparent glow of these paintings. To tellthe truth, it does not seem to me to be so. I seem to have noticed more frequently in these newly finished copies that they were close to the originals in strength, but not nearly as fresh of diaphanous. My impression was worse on seeing them after a certain period of time. They seemed as if emptied of color, black in the shadows, opaque in the luminous spots...

But the indiscriminate copying of paintings was seen as a possible danger from the point of view of the study of technique:

> It is essential that the paintings used for copying be well conserved, and if possible of fresh and lucid color, inasmuch as the passage of time often alters the effects of chiaroscuro and the very colors (of the paintings); (many paintings) frequently also suffer from modification of the surface varnishes due to cleaning, a use that cannot

be condemned often enough.

(Jacopo Alessandro Calvi, in a speech during the award presentations for the academic year 1808)

The practice of cleaning paintings was already a subject of debate, a part of the larger debate on the learning of technique. Finding paintings of good quality for copying served as a stimulus for research in this area.

It should be emphasized that we consider the most important aspect of the academic situation of this period to be the vast number of technical notions available to young artists. The gathering together and organization of artistic knowledge that was the result of this cultural revolution was yielding its first fruits in the unification of hundreds of formulas and teachings that had been dispersed in the past. The library of the Bologna Academy provided a setting for the gathering together of the many treatises on painting, constituting a sort of large informative "corpus" that all students had access to. Moreover, this corpus contained not only local treatises but also materials from countries such as France, primarily, and England, and thereby provided basic texts for the analysis of antique painting techniques.

The paintings produced in the academic environment, although part of a tradition in taste that tended to limit innovative movements, must be appreciated for the capacity these artists possessed to make use of their knowledge of past technical interventions in new and various ways.

In the art exhibits held in the academy, for the purpose of awarding the yearly Curlandese Prizes, the paintings that are present, although coming from different cultural contexts, all demonstrate the importance given to the material aspects of painting. This can be seen in the disparity of efforts presented by each artist, and in certain characteristics of the paintings that have survived various attempts at restoration.

We would like to present three examples of these paintings, giving special attention to the use of varnishing.

The first example to be studied is the painting "Il Valore," by Vincenzo Pizzoli (Piccolo Premio Curlandese, 1822). It must be pointed out that because of an unhappy effort at lightening the surface of the painting, in many parts it appears that the removal of the last layer of varnish has also removed the final glazing that constituted the definitive "final coat"(1) of the painting, that molded and smoothed out the figure. The distorted vision that appears in the "uncovered" part is unconvincing, and should not negatively influence a critical judgement of the painting. Two samples of the painting taken one from an intact area of the painting and one from an area no longer intact, were analysed by physio-chemical methods. The rigorous and minute attention given to the preparation of the canvas may be noticed. Several layers of white priming, varying in thickness and in tonality, probably provided a firmer adhesion to the canvas. The final coat of the painting, in the area where it still exists, demonstrates very little fluorescence under ultraviolet light, indicating the presence of a mixture containing substances other than resin. In the areas where the varnishes have been stripped, the samples show very light traces of the same substance in the furrows of the brushstrokes. Any critical judgement would be less harsh if the painting could recuperate its "own" surface, and therefore the qualities that rendered it worthy of the Curlandese Prize.

In the study of another painting, "Vanity," by Clemente Alberi (Piccolo Premio Curlandese, 1823), it is useful to note that the painter is the son of a renowned copyist of antique paintings, and an important theorist, Francesco Alberi, teacher at the Bologna Academy from 1803 until 1836.

The choice of technique used in the execution of this painting with the conviction that this "manner" of painting would be the most durable, certainly derived from the study and imitation of antique techniques. The appearance is opaque, without variation in luminosity between the colors, which are rather dull and lacking in transparency. There is no trace of varnish either originally or subsequently applied, which might indicate that our vision of the work is different than that which the author obtained on finishing the painting. Physio-chemical analysis of the painting(2) indicates that the canvas was treated with animal glue, flour, and very little oil; over this was placed a layer of red mastic in an oil binder; a blue-green color in the same oil binder has given a yellowish cast to the overlying white color (in this case, white lead), giving it a poorer and duller aspect. Above this is found a light grayish layer which has been determined to be "extraneous" and classified as dust and smoke, but there is no trace of varnish.

Another example, "Oreste insequito dalle Furie," by Luigi Basiletti (Premio Grande Curlandese, 1804), seems to comply completely to those rules of academic competitions prescribing the us e of finishing techniques. The surface of the painting, consisting of opaque glazes, has a warm coloring. If one did not notice traces of varnish scattered around in several minute fragments, recognizable as original by its caracteristics, and which certainly covered the entire painting, the painting would seem to be perfectly intact. In the places where these fragments of varnish do appear, the tonality of the colors is reinforced by exactly those effects that any layering of varnish will produce.

The stratographic study of a sample (blue color) permits the identification of eight very thin layers, the surface layer of which is of extremely flourescent resinous varnish. It also demonstrates that in the intermediate layers there exists a proteic substance.

Even though these three paintings possess such obvious stylistic differences, it is worthwhile to examine them together as to the use of varnish.

By varnish one commonly means to indicate a solution that is an inexact mixture of various substances dissolved in a solvent. The action of these varnishes on the surface of the painting may be categorized as having two functions:

- the formation of a protective layer that guards the colors underneath from external agents such as humidity, abrasion, and light;
- the furnishing of an imperfectly transparent "filter" that tends to render more uniform the tonality of the painting as seen in its entirety, and to reinforce the intensity of the darker colors so that they sink deeper into the background allowing the lighter colors to emerge.

In other words the varnish mutates substantially the appearance of the painting at the time of its definitive completion. This kind of tonal variation was accurately calculated by the artist and forseen in selecting the "final coat" of his product.

A warning issued by Selvatico testifies to the wide use of varnishes for the latter function:

> In painting with glazes it is very important to consider the alterations that occur in the oils and varnishes, since it is inevitable that such substances undergo a yellowing effect. One must calculate the future yellowing of these oily and resinous substances in the preparation of the tints in the glazes.

This perplexity is apparent in various judgements given by the Academic Commission (Commissione permanente per l'Accademia: Calvi, Pedrini, Frulli; 1808):

> Regarding the coloration, it can be noted that in tinting the air, or in other words in creating a slightly rusty background, the artist was forced to spread this same tint over the other objects so that they might agree with the background, an undesirable condition.
>
> The judges would desire a more correct use of drawing and less abuse of varnishes in painting ...

However at the same time another painting was criticized, that would have been worthy of a prize if only:

> ... it wasn't so cutting, nor its contours so hard, cold, and unagreeing in its tints!!!

These judgements indicate that many of the paintings produced in the Academy or shipped there for the annual prize competition, were presented with a "final coat" chosen with particular care to the tonality and thickness.

In a letter accompanying her painting to the competition in 1792, Elizabeth Vigel Le Brun wrote in her own peculiar style:

> Jai l'honeur de vous prevenir que mon petit tableau n'a point di Blanc-d'oeuf (egg white), il nestou pas assez sec Je vous prirez donc Monsieur de vouloir bien en faire metre un artiste; 8 jours apres qu'il sera arrivè a Bologne. Voici la maniere de l'arrangé. C'est d'avoir un Blanc d'oeuf y metre un demie petite cuiellire (cuillère) d'eau devie (acquavite) avec un monceau de suc en die ("sucre candi," candied sugar) gros comme une noisette, sil sen trouve a Bologne. Bâtre le tout ensemble jusqu'a quel faxe mouse ensuite prendre une eponge propre, pour etaler egalement le Blanc d'oeuf sur le tableau sil ny a point de sucen-die ny eau de vie alors battè seulement le Blanc Doeuf.

Although there are no definitive proofs for these suppositions, reconstructed from archivistic materials and chemical examinations; they are of obvious importance to the conservator. The presence of varnishes and oils that have yellowed with age cannot be considered purely as an element disturbing the vision of the art word, but must also be seen as belonging to the technique of painting during this period. These are the years in which research and debate over pictorial technique reached their maximum intensity, after which they are rapidly extinguished as an academic concern.

If we recognize that that which was written in the antique manuals and manuscripts found an expression in that which was realized in practice by the academic painters, one is forced to take a new look at the validity of the actual methods of cleaning paintings of this period, and also to reconsider the critical status of many masterpieces of other periods whose original varnishes have been removed. It is well known that the polemics on the use of oil and varnish as a final glazing go back much farther than the 19th century. These considerations should therefore be extended to both the formal and material appearance of many paintings that have recently undergone restorations altering their original integrity.

(Based on a study originally made for the exhibition held at the Modern Art Gallery, Bologna, 1980)

NOTES:

1) Final coat - in Italian, "rifinitura," means the glaze and/or varnish applied by the artist to either affect the visual aspect of color tones of the painting or preserve it or both.

2) The chemical analyses were made by Drs. Matteini and Moles of the Opificio delle Pietre Dure of Florence.

81/20/2

CONTRIBUTION A L'ETUDE DES SOLVANTS UTILISES EN CONSERVATION

L. Masschelein-Kleiner et J. Deneyer

Comité pour la conservation de l'ICOM
6ème Réunion triennale
Ottawa 1981

Groupe de travail: Peintures de chevalet

CONTRIBUTION A L'ETUDE DES SOLVANTS UTILISES EN CONSERVATION

L. Masschelein-Kleiner et J. Deneyer

Institut Royal du Patrimoine Artistique
1 Parc du Cinquantenaire
1040 Bruxelles
Belgium

RESUME :Le présent travail propose une classification des solvants en fonction de leur pouvoir de pénétration et de leur temps de rétention dans les corps poreux comme le sont la plupart des objets d'art.Partant de ces données et tenant compte des interactions possibles solvant-solvant et solvant-soluté ,nous proposons une liste de mélanges à tester successivement pour résoudre les problèmes de nettoyage.

I.INTRODUCTION

Le nettoyage d'une peinture,d'une sculpture polychromée,d'une peinture murale est toujours une opération dangereuse.Il faut au préalable la justifier très soigneusement et ne l'entreprendre que sur des impératifs d'ordre esthétique ou matériels valablement étayés.

La présente étude se situe au moment où le nettoyage a été jugé indispensable.Elle est destinée à rendre cette opération périlleuse aussi contrôlable que possible.

II.PARTIE EXPERIMENTALE

II.1 Viscosité

Nous avons utilisé un viscosimètre à chute de bille d'après Hoeppler,Haake B/BH,diamètre 15.937 mm,distance de chute 100 mm.Les caractéristiques des billes sont les

suivantes:a)verre borosilicate,densité 2.2g/cm3,diamètre 15.66 mm,K=0.05 mPa.s.cm3/g.s;b)pour les valeurs inférieures à 1cP:verre borosilicate,densité 2.222g/cm3, diamètre 15.81 mm,K=0.006 mPa.s.cm3/g.s.
La cellule est maintenue à 20°C à l'aide d'une circulation d'eau reliée à un thermostat.L'échantillon a un volume de 40 ml.La viscosité dynamique est calculée en cP selon la formule:

$$\eta = K(\rho_1 - \rho_2)t$$

où K est la constante de la bille, ρ_1 est la densité de la bille en g/cm3, ρ_2 est la densité du liquide à la température de 20°C en g/cm3, t est le temps de chute en secondes.
Les glycols et le cyclohexanol présentent des viscosités trop élevées(plus de 20 cP)pour être mesurées par ce dispositif.

II.2 Tension superficielle

L'appareil de mesure est un tensiomètre Dognon-Abribat qui est basé sur le principe suivant.Une lame de platine spécialement dépoli et parfaitement mouillable est amenée au contact du liquide.Ce dernier forme un ménisque autour de la lame et l'attire vers lui avec une force F égale au produit de la tension superficielle T par la longueur de la ligne de contact l:

$$F = T \times 2l = m \times 0.981$$

On mesure m à l'aide d'une balance électromagnétique et l'on déduit T en dynes/cm.

II.3 Vitesse d'évaporation- Rétention

Environ 18 mg de solvant sont déposés à l'aide d'une seringue sur un fragment de peinture de 13 mm de diamètre coupé de manière standard à l'emporte-pièce.Le fragment pèse toujours environ 60 mg.La peinture est une toile ornementale datée de 1896 dont le ciel offre une grande surface uniforme.On y trouve du bleu de Prusse mêlé à du blanc de plomb sur une préparation à base de blanc de plomb. Le vernis contient de la résine mastic.

On suit l'évaporation à l'aide d'une thermobalance Linseis L 51/10S en position horizontale,placée dans une chambre thermostatisée.La vitesse d'enregistrement est de 360 mm/h.Les mesures sont établies sur le palier de la courbe.Les solvants ayant un très long temps de rétention feront l'objet de mesures ultérieures jusqu'au retour au poids initial.

III.RESULTATS ET DISCUSSION

Lorsque l'on dépose une goutte de solvant à la surface d'un tableau ou d'une sculpture polychromée,on observe d'habitude trois phénomènes:
1.une partie du solvant disparait dans les pores et les craquelures; 2.une autre partie s'évapore; 3.parfois le solvant gonfle ou dissout le vernis ou le surpeint présent.Suivons ces trois pistes.

III.1 Pénétration du solvant

La manière dont un solvant pénètre dans un corps poreux est le résultat d'une série complexe de phénomènes: hydrostatiques(siphons,vases communiquants),diffusion, capillarité,adsorption,etc...Deux facteurs aisément mesurables y jouent un rôle important:la viscosité et la tension superficielle du solvant.

On conçoit aisément que les solvants les moins visqueux s'écouleront le plus facilement.La grande majorité des solvants présentent une viscosité très faible,inférieure à 2 cP;les alcools supérieurs à l'éthanol sont de viscosité intermédiaires,entre 2 et 10 cP;la famille des glycols et le cyclohexanol sont très visqueux,plus de 10 cP.
La viscosité d'un mélange ne peut pas se déduire des viscosités des constituants.On constate souvent un maximum ou un minimum en fonction des concentrations respectives.

Par ailleurs,le déplacement du solvant dans les pores de diamètre inférieur à 1 mm obéit aux lois de la capillarité:

$$H = \frac{2A}{\rho g R} \qquad \text{loi de Jurin}$$

où A est la tension superficielle du liquide,ρ la densité du liquide,g l'accélération de la pesanteur, R le rayon du capillaire à l'endroit où s'arrête le liquide et H la distance parcourue par le liquide dans le capillaire.
Cette distance sera donc d'autant plus grande que la tension superficielle du solvant est grande,ce qui signifie aussi que le liquide mouille mal.
Ceci est contraire à l'intuition mais il faut en tenir compte quand on utilise des substances tensioactives par exemple dans les colles de fixage pour les écailles de peinture.En diminuant la tension superficielle de la colle,ces substances améliorent le mouillage à l'endroit où l'on dépose la colle mais elles entravent la migration capillaire de cette dernière.

Tenant compte de ces deux facteurs,viscosité et tension superficielle,nous proposons un classement des familles de solvants en quatre catégories:à pénétration faible,moyenne,forte et très forte(Tableau I).

III.2 Evaporation et rétention du solvant

C'est HANSEN qui proposa le premier la théorie généralement admise aujourd'hui selon laquelle l'évaporation d'un solvant imprégnant un corps poreux s'effectue en deux phases:une phase rapide intéressant le film de solvant resté en surface("wet stage") et une phase plus lente pour le solvant qui a pénétré à l'intérieur du substrat ("dry stage"),[1].

Les vitesses d'évaporation que l'on trouve dans la littérature technique correspondent d'habitude à la première phase.Elles ne tiennent pas compte de la rétention dans l'épaisseur du film.

Il existe pourtant de nombreux travaux sur la rétention des solvants car ce phénomène joue un rôle important lors du sèchage des films de résines[2,3,4,5,6,7,8].On explique d'habitude la rétention par une migration plus ou moins rapide du solvant d'une cavité à l'autre de la substance filmogène.Ainsi s'expliquerait qu'une molécule linéaire soit moins retenue qu'une molécule ramifiée,qu'une molécule plane(benzène) soit moins retenue qu'une molécule non plane(cyclohexane).
De même,une augmentation de la température ou l'inclusion d'un plastifiant faciliteraient la migration et diminueraient donc la rétention.

L'étude de la rétention des solvants dans les couches picturales a été abordée par JONES [4] et DAUCHOT[9] à l'aide de molécules marquées.
Nous avons opté pour une méthode gravimétrique vu la difficulté de se procurer les traceurs correspondant à toute la gamme des solvants utilisés en conservation.
La figure 1 détaille les résultats obtenus.

Nous en déduisons une proposition de classement en quatre catégories:

1)<u>les solvants dont il reste plus de 10% après 1000 min</u>:
éthyleneglycol,formamide,acide acétique,acide formique, butylamine,térébenthine,cumène.
Ces solvants sont très dangereux ,il vaut mieux les éviter ou ne les utiliser qu'en très faible quantité.
= solvants à rétention"TRES FORTE"(Tableau I).

2)<u>les solvants dont il reste plus de 10% après 100 min.</u>:
diacétonealcool,diméthylformamide, white spirit,tertiobutylamine.
Hormis le white spirit dont le pouvoir solvant est très limité,il faut tenir compte de la rétention non négligeable de ces solvants.Ils sont à éviter sur des peintures récentes,y compris celles du XIXe siècle.
= solvants à rétention "FORTE".

3)<u>les solvants dont il reste moins de 10% après 100 min.</u>:
méthanol,éthanol,propanol,isopropanol,butanol,isobuta-

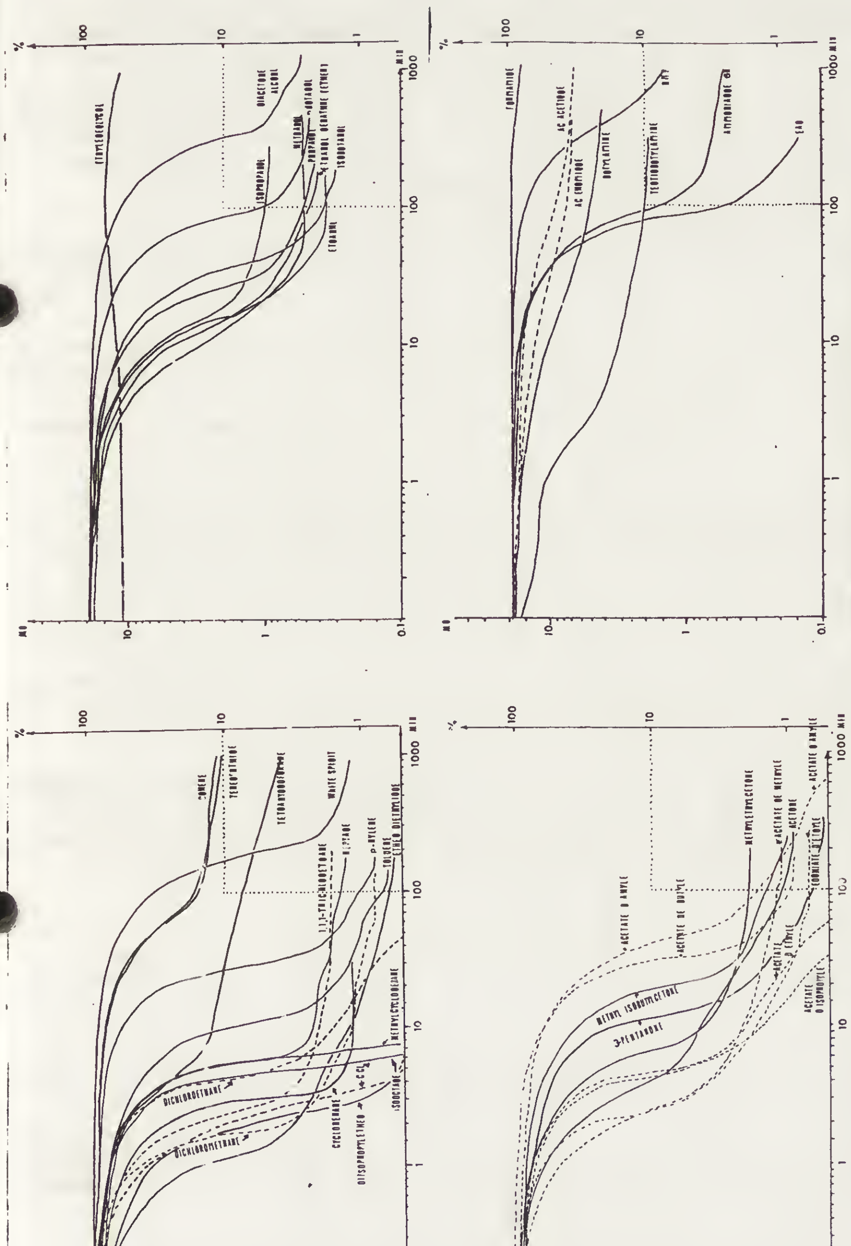


FIGURE 1:Evaporation et rétention des solvants

-nol,eau,ammoniaque(6N),acétone,méthyléthylcétone,2-et 3-pentanone,méthylisobutylcétone,formiate d'éthyle, acétate de méthyle,acétate d'éthyle,acétate d'isopropyle,acétate de butyle,acétate d'amyle,heptane,isooctane,cyclohexane,méthylcyclohexane,benzène,toluène, paraxylène,tétrachlorure de carbone,chloroforme,dichlorométhane,dichloroéthane,1,1,1-trichloroéthane,dioxane, tétrahydrofurane,éther diéthylique,diisopropyléther...
Cette liste non limitative regroupe la majorité des solvants utilisés en conservation.
= solvants à rétention"FAIBLE".

4)les solvants dont la rétention est pratiquement nulle:
Parmi les solvants de la catégorie 3) , il en est dont la quantité retenue n'est plus détectable par nos moyens:
isooctane,méthylcyclohexane,diisopropyléther,tétrachlorure de carbone,dichloroéthane,acétate d'éthyle,acétate d'isopropyle,benzène.
C'est une des raisons qui nous a fait choisir l'isooctane comme diluant dans nos mélanges(voir plus loin).

En conclusion,pour éviter des interactions qui peuvent être nuisibles à longue échéance,il est à recommander de sélectionner des solvants à faible rétention(catégories 3 et 4); vu le nombre et la diversité de ces solvants , ce choix est possible pour la majorité des traitements.

Quand il faut avoir recours à des solvants à rétention plus élevée(élimination de surpeints huileux),il est prudent de n'en utiliser qu'une quantité aussi minime que possible,d'essuyer soigneusement l'excédent avec plusieurs tampons d'ouate sèche,et d'accélérer finalement l'évaporation à l'aide d'un sèche-cheveux.
Il est en effet illusoire d'avoir recours à des"rinçages" Cela ne fait qu'augmenter la quantité des solvants qui pénètre dans les couches de peinture et qui devra ensuite en ressortir.

III.3 Action dissolvante

Pour dissoudre un solide,les molécules de solvant doivent s'introduire entre les molécules de ce solide , et les disperser en surmontant les forces d'attraction qui les unissaient.
En fait,la plupart des substances filmogènes vieillies ne se laissent plus disperser jusqu'à l'échelle des molécules.Elles ne forment plus une solution,le solvant parvient seulement à les gonfler jusqu'à un état proche du coacervat(10).Cet état de ramollissement permet néanmoins leur élimination mécanique au scalpel ou au tampon d'ouate.

La nature des interactions possibles d'un solvant donne une idée des substances qu'il est susceptible de dissoudre.

Les principales forces d'interaction sont[11,12]:

a)les FORCES D'ORIENTATION,entre molécules qui par suite d'une distribution non symétrique des charges électriques présentent un MOMENT DIPOLAIRE.

b)les FORCES INDUITES entre molécules dipolaires et non dipolaires.La POLARISABILITE de la molécule sans dipole permanent favorise la formation du dipole induit.

c)les FORCES DE DISPERSION entre molécules non dipolaires.

d)les FORCES DE LIAISON HYDROGENE,ou mise en commun d'un atome d'hydrogène entre un donneur de proton et un accapteur de proton portant une paire d'électrons libres.

e)les FORCES COULOMBIENNES entre ions.Les solvants qui parviennent à surmonter ces puissantes forces d'interaction sont dits "dissociants".

f) les FORCES DE TRANSFERT DE CHARGE entre un donneur et un accepteur d'électrons.Ces solvants sont dits "coordinants" car ils forment des liaisons de coordination avec le soluté.Comme c'est le pouvoir donneur d'électrons qui détermine l'aptitude à ioniser les composés dissouts ils sont aussi souvent "ionisants".

TABLEAU 1

Propriétés des principales familles de solvants

solvants	pénétration	rétention	interactions	solutés
hydroc. saturés	faible	faible	(c)	paraffines,graisses, cires,bitumes,color. caroténoides,caoutch. natur.,polycyclohexanone,butylmétacrylate
hydroc. aromat.	forte	faible	(b)(c); (d)(f): peu	idem(cfer + haut) + résines natur.fraîches(pas shellac,copals,sandarac) la plupart des résines synthétiques.
dérivés chlorés	forte à très forte	faible	(c) (a):peu (b):arom.	idem(cfer + haut)

solvants	pénétration	rétention	interactions	solutés
esters	moyenne	faible	(c); (a)(b)(e): très peu (d)capt.H: peu	idem (cfer+haut)+ qq.colorants
éthers	faible	faible	(c)(f) (d)capt.H (a)(e): très peu	idem(cfer+haut) pas les résines synthétiques
alcools:				idem(cfer+haut)+ shellac,sandarac, copals frais , PVA,cert.acryliques
méthanol éthanol	moyenne	faible	(c)(d)(e) (f)	
autres	faible	faible	idem	
diacétone alcool	forte	faible évapor. lente	idem+(a)	
cétones	moyenne	faible	(a)(c) (d)capt.H (e)(f)	idem(cfer+haut) plupart des résines natur.et synth.(pas shellac),colorants, encres,peint.à l'huile récentes.
glycols polyols éthers et esters	très forte	très forte	(a)(b)(c) (d)(e)(f) hygroscop.	décapants très dangereux:à éviter
amides	très forte	forte à très forte	(a)(b)(c) (d):DMF capt.H (e)(f)	décapants:éviter formamide, à éviter sur des peintures récentes y compris XIXe siècle.
amines	très forte	très forte	(b)(c)(d) (f)	dangereuses,toxiques à éviter
NH_4OH	idem	forte		huiles polym.shellac
acides carbox.	très forte	très forte	(a)(d)(f)	protéines

<u>Rappel</u>: (a)forces d'orientation, (b)forces induites, (c) forces de dispersion, (d)liaison hydrogène, (e)forces coulombiennes, (f)forces de transfert de charge.

IV.CONCLUSION:CHOIX DES SOLVANTS

Nous partons du principe qu'il faut éviter les solvants dangereux pour la peinture(à pénétration et rétention très fortes), ou pour l'utilisateur et ceux qui ont tendance à former des produits colorés(essences de térébenthine et d'aspic,acétylacétone,isophorone,etc...).

Il est souvent favorable d'employer un mélange contenant un "diluant" peu pénétrant,peu retenu et peu actif et un solvant plus efficace.Selon l'effet observé,on pourra ainsi augmenter ou diminuer la concentration du solvant actif.
Ceci n'est réalisable qu'avec des mélanges simples,ayant deux,ou maximum trois constituants.Il est d'ailleurs erroné de croire qu'en faisant des mélanges compliqués de nombreux solvants on additionne leur efficacité.Bien au contraire les interactions multiples qui s'établissent entre eux entrent en compétition avec la solvatation.

Nous proposons la liste suivante de mélanges de solvants .Ils se sont révélés les plus favorables à l'utilisation.

TABLEAU II
Liste des solvants(à tester successivement)

solvants	proportions	usage
isooctane		dégraissant
white-spirit		idem (cire)
diisopropyléther		cire
paraxylène		dégraissant, vernis Keton N frais
isooctane+isopropanol	50/50	vernis résineux
isopropanol+toluène	50/50	idem
isooctane+éthanol+éther	80/20/10	idem
" " "	55/30/15	idem
isopropanol+méthyléthylcétone	75/25	idem
isopropanol+méthylisobutylcétone	50/50	
méthanol+dichloroéthane	50/50	surpeints(huile)
isopropanol+ammoniaque+eau	90/10/10	idem
" " "	50/25/25	idem
toluène+diméthylformamide	75/25	idem
acétate d'éthyle + DMF	50/50	idem
formiate d'éthyle+dichloro-méthane+acide formique	50/50/2	protéines
isopropanol+toluène+eau	65/50/15	polysaccharides

BIBLIOGRAPHIE

[1]C.M.HANSEN,"A mathematical description of film drying by solvent evaporation",J.Oil Col.Chem.Assoc.,51(1968) 27-43.

[2]G.M.SLETMOE,"The evaporation of non hydrogen bonding solvents from resin films",J.of Paint Technology,38 (1966)642-653.

[3]D.A.SULLIVAN,"Water and solvent evaporation from latex and latex paint films",J.of Paint Technology,47(1975) 60-67.

[4]R.L.FELLER,N.STOLOW et E.JONES,"On picture varnishes and their solvents",The Press of Case Western Reserve University,Cleveland and London(1971).

[5]M.YASEEN et H.E.ASHTON,"Solvent retention in phenolic varnish films",J.OilCol.Chem.Assoc.,53(1970)977-988.

[6]D.J.NEWMAN et C.J.NUNN,"Solvent retention in organic coatings",Progress in organic coatings,3(1975)221-243.

[7]C.M.HANSEN,"Vinyl chloride retention in coatings formed from solutions",J.Oil Col.Chem.Assoc.,60(1977) 245-248.

[8]M.DAUCHOT-DEHON et E.DE WITTE,"Etude du temps de séchage du vernis Paraloid B72 sur les peintures", 5e Réunion Triennale ICOM,Zagreb(1978)78/16/2.

[9]M.DAUCHOT-DEHON,"Les effets de solvants sur les couches picturales.1.Alccols et acétone",Bulletin IRPA, XIV(1973)89-104.

[10]L.de BROUCKERE,"Etude des systèmes colloidaux", Desoer,Liège(1945).

[11]C.REICHARDT "Effets de solvants en chimie organique", Flammarion Sciences,Paris(1971).

[12]G.TORRACA,"Solubility and solvents for conservation problems",Centre International pour la Conservation, Rome(1975).

81/20/3

LE BLANCHIMENT: UN CAS PRECIS D'ETUDE

Ségolène Bergeon, Graciella Mondorf,
Suzy Delbourgo et Jean-Paul Rioux

Comité pour la conservation de l'ICOM
6ème Réunion triennale
Ottawa 1981

Groupe de travail: Peintures de chevalet

LE BLANCHIMENT: UN CAS PRECIS D'ETUDE

Ségolène Bergeon, Graciella Mondorf, Suzy Delbourgo et Jean-Paul Rioux

Ségolène Bergeon et Graciella Mondorf
Service de la Restauration des Peintures des Musées Nationaux
Musée du Louvre
Palais du Louvre
Paris 75001
France

Suzy Delbourgo et Jean-Paul Rioux
Laboratoire de Recherche des Musées de France
Palais du Louvre
75041 Paris Cedex 01
France

SOMMAIRE

L'étude du blanchiment conduit à distinguer les "chancis de couleur " et les blanchiments en général des chancis de vernis. On fait l'inventaire d'un certain nombre de cas de blanchiment que le Service de Restauration des Peintures des Musées Nationaux a eu récemment à examiner et on donne le résultat d'une étude effectuée en collaboration avec le Laboratoire de Recherche des Musées de France sur un tableau de Romanelli. Cette étude a conduit à relier le blanchiment dans ce cas précis à une altération du liant sous l'action de l'oxygène ou de l'humidité de l'air. Un traitement spécifique a pu être recommandé et a donné satisfaction, mais il y aurait lieu de bien définir les conditions d'emploi du produit utilisé dont le mécanisme d'action est de nature chimique et de surveiller le comportement du tableau au vieillissement.

A la demande de restaurateurs du Service de la Restauration des Peintures des Musées Nationaux (1), une étude concertée sur le blanchiment -où les deux partenaires ont été le Service de Restauration et le Laboratoire de Recherche des Musées de France- a été entreprise.

Un premier travail effectué au Service de Restauration a consisté à rassembler des cas représentatifs des divers phénomènes groupés sous le vocable de blanchiment. Dans une deuxième phase, le laboratoire aura à analyser scientifiquement le phénomène et essaiera de déterminer les causes de l'altération. Le troisième travail, celui des restaurateurs consistera à trouver comment pallier l'altération, si sa réversibilité est possible.

On ne retiendra pas dans cette étude les problèmes de chanci de vernis, altération superficielle bien connue et opacification qui pourrait être due entre autres raisons à une microfissuration du vernis.

Le mot blanchiment, traduction française du mot anglais "blanching", sert à désigner une altération de la couleur qui apparaît sous le vernis, quelle qu'en soit la cause. Le phénomène de blanchiment peut être dû selon le cas à une altération du pigment, du liant, ou être le résultat d'une interaction entre pigment et liant (2).

Le mot "chanci de couleur" est souvent utilisé, avec des significations diverses selon les ateliers, pour désigner un blanchiment. Il pourrait être réservé , par analogie avec le terme "chanci de vernis", aux phénomènes de même nature que celui-ci, c'est à dire de microfissuration du liant, qui peuvent être une des causes du blanchiment.

I- INVENTAIRE DES ALTERATIONS

Nous présenterons d'abord l'inventaire, classé par couleurs, d'un certain nombre d'altérations qui ont été observées sur des tableaux en cours de restauration et qui sont imputables d'une manière générale à des phénomènes de blanchiment.

Blanchiment des bleus

Nous réservons une mention toute particulière à un phénomène bien connu des spécialistes, la décoloration du smalt dans l'huile (3), parce que ses apparences peuvent être multiples selon l'usage de ce pigment, pur ou en mélange, en glacis sur un autre bleu ou sur un rouge pour obtenir à l'origine un violet.

Louvre INV 516 CANDIDO "Sainte Famille"

Le manteau de la Vierge présente des plages de couleur indéfinissable jaunâtre, opaque : il s'agit de smalt altéré qui à l'origine avait été utilisé en glacis sur un rouge sous-jacent pour obtenir un violet.

Louvre INV 130 BRONZINO "Le Christ et la Madeleine"

Présence de deux plages gris-jaunâtre (aiguière ; drapé du christ) : smalt altéré.

Louvre INV 732 VASARI "La salutation angélique"

Le smalt est très altéré dans les zones riches en liant du manteau de la Vierge, peu altéré soit sur le bord du tableau protégé par le cadre, soit dans les zones chargées en blanc (lumières du drapé). L'harmonie chromatique voulue par Vasari se trouve aujourd'hui transformée par l'altération du smalt.

Louvre INV 1052 BLOMAERT "L'Adoration des bergers"

Une étrange couche jaunâtre, opaque, sur le manteau de la Vierge a été considérée autrefois à tort comme un chanci persistant non régénérable. En fait il s'agit d'une couche riche en smalt qui s'est altérée.

Louvre RF 1961-12 VOUET "La prudence amène la Paix et l'Abondance"

Musée Magnin, Dijon VOUET "Vierge à l'enfant"

Dans ces deux cas, les ombres des plis des manteaux bleus, réalisées en smalt, sur fond de lapis dans la Prudence du Louvre, d'azurite dans la Vierge de Dijon sont devenues jaunâtres et opaques : l'altération a inversé le rapport ombre-lumière.

Musée Magnin, Dijon Ex-MORAZZONE "Déposition de Croix"
Francesco del CAIRO

Le manteau de la Vierge bleu grisâtre s'est révélé être constitué de smalt très décoloré.

Louvre INV 2007 TOURNIER "Crucifixion"

Les plis de la robe de laque rouge de la Madeleine, constitués de smalt mêlé de laque, apparaissent aujourd'hui opaques et jaunâtres : l'effet violet original est fortement trahi par l'altération complète du smalt.

Musée de l'Assistance Publique de Paris COYPEL "l'Adoration des bergers"

Ici les plis du manteau de la Vierge présentent une couleur gris-jaunâtre très prononcée dans les ombres : l'analyse révèle un mélange de smalt et de lapis, riche en lapis inaltéré dans les lumières, riche en smalt très altéré dans les ombres.

Il nous a semblé intéressant de mentionner ces divers exemples d'altération du smalt qui entraîne une dénaturation importante de la couleur originale. Si le phénomène est aisément reconnaissable par des restaurateurs et des scientifiques, il nous parait utile que les historiens d'art soient avertis que la couleur actuellement visible est le résultat d'une altération irréversible.

Signalons aussi deux exemples de "maladie de l'outremer", qui est une destruction irréversible du lapis par l'acidité du milieu (4) :

Louvre INV 8037 LESUEUR "Saint Bruno confirme la règle des Chartreux"

Hôpital de Garches RIVALZ "La guérison de l'aveugle"

Blanchiment du rouge

On constate souvent dans les ombres des plis des drapés rouges une opacification partielle des glacis superficiels riches en liant qui semblent microfissurés :

Musée Condé, Chantilly ENGUERRAND QUARTON "La Vierge de Miséricorde"

Louvre INV 1466 METSU "Portrait de l'Amiral Tromp"

Louvre INV 20456 GERARD " Charles X"

Blanchiment du vert

Cette altération se produit souvent dans les paysages du XVIIème siècle.

Louvre INV 5362 MAUPERCHE "Paysage"

Louvre MI 954 PYNACKER "Paysage"

Blanchiment du brun

Ce phénomène est généralisé à toute une plage brune :

Louvre INV 533 G. RENI "Saint François" (vêtement du Saint)

Louvre MI 981 SNYDERS "Les singes voleurs de fruits" (bords riches en glacis bruns)

Louvre INV 576 ROMANELLI "La récolte de la manne dans le désert" (sur le vêtement jaune-brun de la femme agenouillée)

Ce dernier tableau fait l'objet d'une discussion ci-après.

Ou bien le blanchiment est localisé dans les ombres brunes des carnations des compositions du XVIème siècle, peintes sur bois, dont la matière lisse et transparente est riche en liant :

Louvre INV 841 SEBASTIANO DEL PIOMBO "Saint Antoine"

Musée Condé, Chantilly LUINI "Le sommeil de l'Enfant Jésus"

Louvre INV 97 FRA BARTOLOMEO "Le mariage mystique de Sainte Catherine"

Peut-être l'évanouissement du stil de grain est-il la cause de la destruction de la couleur dont seul le support du colorant subsiste (2).

II- EXAMEN DU LABORATOIRE

Une partie des cas ainsi recensés a été l'objet d'examens au L.R.M.F. Nous rapporterons ici l'étude effectuée sur un tableau de Romanelli, "La récolte de la Manne dans le désert" (H. 1,98 x L. 2,12 m), qui fait partie d'une série de sept tableaux sur l'histoire de Moïse : peints en 1657, ils ont décoré les appartements d'Anne d'Autriche au Louvre.

Un vernis très jauni et épais recouvrait toute la surface picturale. Après allègement du vernis, on a constaté la présence sous ce vernis de zones présentant à l'oeil un phénomène de blanchiment. Les plages concernées sont les suivantes :

- la draperie vert sombre qui revêt le personnage agenouillé à senestre,
- le sol verdâtre en bas,
- la robe beige de la femme à dextre,
- la poterie brune tenue par le personnage à senestre.

Le phénomène visible à l'oeil n'est pas décelable à l'examen microscopique de la surface.

La couleur verte de la draperie présente cependant un cas particulier. En sus du phénomène de blanchiment observé à l'oeil, on décèle au microscope la présence d'une altération constituée de microcraquelures superficielles en forme d'arborescences et qui affecte une mince couche de vernis ancien encore présent en surface après un allègement. Il s'agirait dans ce cas d'un chanci de vernis, dont l'effet optique vient s'ajouter au blanchiment de la couche picturale sous-jacente.

En outre, il faut signaler, à la surface de la robe beige de la femme à dextre et sur l'urne à senestre, la présence de petites taches brunes qui correspondent à des zones où des repeints et des mastics ont été récemment enlevés.

L'étude stratigraphique de la matière picturale ainsi que l'analyse des différents constituants ont été effectuées sur des échantillons prélevés aux endroits concernés, de façon à connaître, d'une part la nature de la matière picturale, et d'autre part à tenter de voir si ces phénomènes apparaissent visibles dans la profondeur de la matière.

L'analyse a révélé que la matière picturale est constituée d'une préparation rouge orangé composée de grains d'ocre rouge à gros broyage enrobés dans une quantité importante de liant jaunâtre parfois concentré en gouttelettes. La couche de couleur, unique, est elle aussi riche en liant.

La préparation et la couche picturale sont étendues avec un liant huileux présentant une forte acidité qui pourrait être due à l'adjonction d'une quantité notable de résine naturelle ayant vieilli.

Dans la plupart des cas de blanchiment que nous avons rencontrés, la différence d'aspect entre les coupes d'échantillons issus de zones altérées et les coupes d'échantillons issus de zones saines de même couleur ne se manifeste pas toujours de façon significative. Parfois le blanchiment affecte une épaisseur notable de la couche colorée, parfois il se limite à une zone superficielle très mince difficilement perceptible sur les coupes.

Dans le cas du Romanelli étudié, le blanchiment n'est pas visible sur la coupe. Une observation intéressante a cependant pu être faite sur les coupes : la matière colorée de celles-ci, initialement peu blanchie, s'est couverte à l'air de zones blanchâtres affectant des parties plus profondes. Ce blanchiment, non existant lors de la fabrication de la coupe, est progressivement apparu par la suite et présente le même aspect que celui qui a été initialement observé à la surface du tableau. Un nouveau polissage de la coupe l'élimine complètement.

Ces faits semblent montrer que le blanchiment est provoqué par une cause externe (rôle de l'humidité ? rôle de l'oxygène ?) et qu'il évolue en progressant de la surface vers l'intérieur de la couche colorée.

Cette observation est corroborée par la présence sur la robe beige des taches brunes mentionnées plus haut. Celles-ci n'étaient pas, contrairement à ce qu'on a d'abord pensé, des altérations de la couleur originale, mais au contraire des zones représentatives de la matière originale demeurées intactes parce que préservées des influences extérieures par les mastics ou les repeints. Par contre, la couleur beige de la robe serait le résultat d'un blanchiment généralisé du brun initial.

Une matière susceptible de blanchir peut donc demeurer inaltérée si elle est efficacement protégée des influences extérieures par une autre couche picturale.

L'observation au microscope de la matière blanchie présentée sous forme de coupes a montré que les pigments ne paraissent pas être impliqués dans le phénomène et que celui-ci se manifeste dans les zones les plus riches en liant.

En effet, les couches où l'apparition du blanchiment est la plus favorisée sont généralement des glacis épais et homogènes (cas de la couleur verte contenant du résinate de cuivre), ou des semiglacis, couches riches en médium et ne contenant qu'une faible quantité de pigments généralement translucides dispersés dans le liant (cas des couleurs brunes). Par ailleurs, le blanchiment ne se manifeste pas dans les matières colorées chargées en pigments opaques (blanc de plomb par exemple). Ainsi une couleur semble d'autant plus susceptible d'être le siège d'un blanchiment intense qu'elle est à l'origine riche en liant altérable, pauvre en pigment et étendue en couche épaisse.

L'hypothèse la plus vraisemblable concernant le support physique précis de l'altération est la formation d'une microstructure de nature non encore identifiée (microfissuration, microcristallisation, microprécipitation, microémulsion,...) ayant pour conséquence des réflexions multiples au sein du liant de la couche colorée, associées à une diminution de la transparence de la matière (5). Les observations faites en microscopie optique ne permettant pas de vérifier cette hypothèse, des essais au microscope électronique à balayage (G = 1000) sont en cours d'expérimentation.

Comme on l'a vu, la cause du blanchiment dans le tableau de Romanelli est vraisemblablement liée à la nature des constituants du liant et à sa technique d'élaboration. L'analyse a montré que dans ce cas la matière picturale contient un liant à l'huile probablement additionné de résine. Or on sait que les résines vieillies sont aisément dégradables par l'humidité qui peut dissoudre une partie de leurs constituants acides (6) et provoquer des phénomènes de microfissurations par perte de substance et opacification par réflexion dans un milieu hétérogène à nombreuses interfaces. Ce phénomène physique, qui provoque l'altération des vernis appelé chanci, pourrait être également à l'origine du phénomène de blanchiment des liants contenant des résines.

III- <u>ESSAIS DE TRAITEMENT</u>

Compte tenu des précédentes observations, il a été procédé dans un premier temps à des essais avec des produits généralement utilisés pour traiter les chancis de vernis, tels le diacétone alcool, la diméthylformamide, etc...(7). Mais aucune action efficace n'a été constatée sur le blanchiment.

Nous avons alors tenté d'utiliser un produit qui, dans des cas semblables, avait donné de bons résultats (8). Il s'agit du diméthyl-amino 2- éthanol. L'essai s'est révélé positif et toutes les parties blanchies ont pu être traitées avec ce produit, avec un résultat satisfaisant et durable.

Le mécanisme d'action pourrait faire intervenir une salification des acides libres qui conduirait à la formation de sels d'ammonium et à une solubilisation entraînant le bouchage des microfissurations.

Il resterait à déterminer :

- si une augmentation de l'acidité du liant (liée éventuellement à la présence de résine) est fréquente dans les phénomènes de blanchiment dûs au liant,
- de plus, le processus invoqué pour le mécanisme d'action du diméthyl-amino 2-éthanol étant de nature chimique, quel en serait le comportement au vieillissement, cette réserve commandant la prudence dans l'emploi de ce produit.

NOTES ET REFERENCES

(1) Marie-Alice BELCOUR, Jean-Claude CELLIER, Franziska HOURRIER
Anne LEPAGE, Geneviève LEPAVEC

(2) L'article essentiel sur le sujet est :
Joyce PLESTERS Possible causes of blanching involving changes in pigments or interaction of pigment and medium
National Gallery Technical Bulletin Vol. 4, 1980

(3) Joyce PLESTERS A preliminary note on the incidence of discolouration of smalt in oil media
Studies in Conservation, Vol. XI, 1966, n° 2

Bruno MUHLETHALER et Jean THISSEN Identification of the materials of painting : smalt
Studies in Conservation, Vol. I, 1969, n° 2

Rudolf GIOVANOLI et Bruno MUHLETHALER Investigation of discoloured smalt
Studies in Conservation, Vol. XV, 1970, n° 1

(4) Joyce PLESTERS Identification of the materials of paintings : ultramarine blue, natural and artificial
Studies in Conservation, Vol. XI, 1966, n° 2

(5) John MILLS Blanching of the paint film involving possible changes in the medium
National Gallery Technical Bulletin, Vol. 4, 1980

(6) Jean PETIT Examen chimique d'un vernis à la fin du XVIIIème siècle après vieillissement naturel sur un tableau
Congrès triennal du Comité de Conservation de l'I.C.O.M., Venise, 1975, Vol. 3, 22,7

(7) Herbert LANK, Viola PEMBERTON-PIGOTT et Joyce PLESTERS
The use of dimethyl formamide vapour in reforming blanched oil paintings
I.I.C. Congress, Lisbon 1972, Conservation and Restauration of picturial art, Butterworths

(8) Traitement suggéré par André RYZOW, restaurateur au Service de Restauration des Peintures des Musées Nationaux, formé au Centre de Restauration de Torun (Pologne)

81/20/4

WHITE PIGMENTS IN JAPANESE PAINTINGS

John Winter

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Easel Paintings

WHITE PIGMENTS IN JAPANESE PAINTINGS

John Winter

Freer Gallery of Art
Smithsonian Institution
Washington, DC 20560
USA

Japanese white pigments before modern times fall into three groups: white clays, white compounds of lead, and oyster-shell white (calcium carbonate). White-clay pigments were commonly used up to the 15th or 16th centuries and show some variation of composition, perhaps corresponding to geographical origin. Lead-based white pigments were for long assumed to correspond to basic lead carbonate or 'lead white'. Recent work at the Freer Gallery of Art has shown that basic lead chloride is also frequently found. Around the 15-16th centuries, white clays were entirely displaced, and lead compounds partly displaced, by a calcium carbonate white made from pulverized oyster shells.

Introduction

The range of pigments used in Japanese paintings is, for the most part, both limited and fairly unchanging over historical time. However, some variations of usage do occur. The best-established ones are: (a) blue pigments--for example, azurite was sometimes replaced by indigo, perhaps when the former was in short supply (1); (b) the introduction of new pigments in comparatively recent times, either through contact with the west or by the development of the 'glass-matrix' colors (1, 2); (c) white pigments. The last of these forms the subject of this note.

Probably the best-known Japanese white pigment is oyster-shell white (2, 3), a material that appears to be unique to that country*. At one time there appears to have been an assumption that the use of shell white extended back over all known periods of Japanese painting, but this is almost certain to be incorrect. Other classes that we may consider are white clays, and white pigments based on lead. In modern times, zinc oxide and titanium dioxide may be found, but the use of these appears to be very recent. Mica (muscovite) has sometimes been used as a pigment, but probably more for the special effects obtained from the high reflectivity of the particles rather than as a conventional white (4).

White clays

The earliest white-clay identifications are from paintings in pre-Buddhist tombs of the 6th century A.D. (1). In addition, Yamasaki has identified white clay in wall paintings of the 8-16th centuries in a number of Japanese temples (1), and described this material as one of the characteristic pigments of Japan, at least in earlier periods. It has also been found on scroll paintings in a number of instances, for example on nine Buddhist paintings of the 12-15th centuries in the Freer Gallery of Art (5). The period of use was from the earliest known paintings up to its displacement by shell white in the 15-16th centuries.

X-ray diffraction studies in the Freer Gallery of Art on white-clay pigments have shown up some variation in composition (6). The extent of this has not been fully defined, but generally they appear to fall into two classes: (a) pulverized quartz, usually mixed with various other minerals probably related to palygorskite in many cases; (b) kaolinite, often relatively pure. These types may well reflect different geographical localities from which the clays were extracted, but details of such associations have not been worked out up to the present.

White compounds of lead

Lead white (basic lead carbonate), extensively used in European painting practice before the present century, is also known in East Asian paintings, though it was not used so widely. Its manufacture in China by some equivalent of the Dutch process appears to go back to at least 300 B.C. (7). In Japan it has been reported on paintings, for example by Yamasaki and Emoto (1), Gettens (2), and

---

*Historically, Chinese painters are reputed to have used a white made from clam shells, but I am unaware of any identification of such a material on a painting.

FitzHugh (8).

In certain cases, a report of 'lead white' appears to have been based solely on evidence such as the density of a white pigment to radiographic x-rays, or to a chemical finding of lead in a microscopic sample. Recent work using x-ray diffraction (9) has shown that in Japanese paintings basic lead chloride is often the white pigment found, rather than the basic carbonate. On 28 Japanese paintings attributed to the 15th century or earlier in the Freer Gallery of Art, 20 were found to carry basic lead chloride, 6 had basic lead carbonate, and 2 carried both of these white pigments. Thus the basic chloride occurred almost three times as often as the basic carbonate in this particular set of paintings. So far, however, the basic chloride has not been found on a work from China or Korea. The historical significance of these results will be discussed in the full publication (9) and is presumably related to pigment manufacturing methods being practised in Japan before the onset of the use of shell white.

The above work was complicated by the fact that the basic lead chloride can appear in either or both of two forms. The commoner of these is laurionite, $PbOHCl$ (10), a crystallographic form often obtained by precipitation from solution. In addition, a compound that appears to be related to the non-stoichiometric lead oxide chloride blixite (11) sometimes appears in conjunction with laurionite. The method by which the basic chloride was made is not known at present.

Lead whites also occur, though rarely, on later Japanese paintings. Several in the Freer Gallery of Art from the Edo period proved to have basic lead carbonate (2, 8).

Other white compounds of lead have occasionally been found. Lead sulfate was reported on the ceiling paintings of the 8th-century Tōshōdaiji temple in Nara (12). An unprecedented discovery was that of lead phosphate on a 14th-century Buddhist painting in the Freer Gallery by the author (9). Lead sulfate was also found on a Chinese painting of the Yuan or Ming periods (9).

Calcium carbonate whites

From about the 16th century onward, the dominant white pigment in Japanese paintings becomes shell white (1, 2, 3, 8). The method of manufacture, described by Gettens (2), consists in the cleaning and pulverizing of oyster shells (after an aging period to allow organic matter to decompose) following by levigation and washing of the product. This pigment is perhaps unique to Japan (1). It appears to have displaced the white clays, and partly displaced the lead whites, around the 15-16th centuries. Yamasaki has been quoted (3) as suggesting the paintings in Hokanji temple in Kyoto (reconstructed 1439) as the earliest established usage of this pigment, though presumably occasional earlier occurrences remain a possibility.

The Japanese word gofun is usually used in Japan in modern times for the oyster-shell pigment, and this word has to some extent been adopted into English (e.g. 2, 3). It should be noted that the same word has historically been used for other white pigments in Japan, in particular for lead white (4). In addition, the same two-character compound (胡粉) has been used in Chinese to signify lead white (13, 14).

Although shell-white as such was probably not used in earlier periods, lime plaster can be found as a ground for tomb paintings. A notable instance is the 7-8th century tomb of Takamatsuzuka, excavated in 1972 (1, 15).

References

(1) K. Yamasaki, Y. Emoto, Ars Orientalis, 1979, 11, 1-14

(2) R. J. Gettens in Brommelle, Smith (eds), Conservation and Restoration of Pictorial Art, IIC and Butterworths 1976, pp. 241-52.

(3) R. J. Gettens, E. W. FitzHugh, R. L. Feller, Studies in Conservation, 1974, 19, 157-84.

(4) H. Oguchi, Bulletin of the Faculty of Fine Arts, Tokyo University of Arts, 1969, No. 5, 27-82.

(5) E. W. FitzHugh, J. Winter, unpublished work.

(6) J. Winter, unpublished work.

(7) J. Needham, Ho Ping-yü, Lu Gwei-djen, Science and Civilisation in China, vol. 5 part 3, Cambridge University Press 1976, pp. 16-17.

(8) E. W. FitzHugh, Ars Orientalis, 1979, 11, 27-38.

(9) J. Winter, in press.

(10) For x-ray diffraction pattern, see: International Centre for Diffraction Data, Powder Diffraction File 6-268.

(11) Powder Diffraction File 12-542; O. Gabrielson, A. Parwel, F. E. Wickman, Arkiv för Mineralogi och Geologi, 1958, 2, 411-5.

(12) A. Mogi, T. Nakasato, Y. Emoto, Science for Conservation, 1975, No. 14, 55-69.

(13) J. Needham, Lu Gwei-djen, Science and Civilisation in China, vol. 5 part 2, Cambridge University Press 1974, p. 175.

(14) Li Ch'iao-p'ing, The Chemical Arts of Old China, published by the Journal of Chemical Education 1948, p. 134.

(15) K. Yamasaki, Y. Emoto, Bulletin de l'Institut royal du Patrimoine artistique, 1975, 15, 420-8.

81/20/5

A NEW METHOD OF CLEANING BROWNED MEDIEVAL GLASS

Stephan Fitz

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Easel Paintings

A NEW METHOD OF CLEANING BROWNED MEDIEVAL GLASS

Stephan Fitz

Deutsches Museum
München
Fed. Rep. of Germany

During the past years some methods have been recommended for removing the weathering crusts which usually develop on medieval stained glass. Glasses containing higher amounts of iron and manganese sometimes corrode under formation of unsoluble dark brown oxides and oxide hydrates of these elements. The transparency is sometimes reduced to an extent which considerably impairs the appearenance of the stained glass windows. As far as known no method has been reported for cleaning these browned glasses up till now.

Reduction of the brown corrosion products my means of 24 % hydrazine hydroxide showed a brightening effect of the treated glass. The treatment turned out to be harmless for the glass.

Introduction

The weathering of medieval stained glass usually takes place under formation of weathering crusts (1,2). These deposits, which form on the glass surface as corrosion products, are mainly composed of gypsum and syngenite. They may contain solid impurities which come from the atmospheric surroundings (e. g. quartz, rust, soot). They can reach a thickness up to a few millimeters and may strongly reduce the transmission of light. Cleaning of the glass for instance with a glass-fibre brush causes no great problems for a restorator. The transparency of the glass can often be restored in a satisfactory way if the third or half of the thickness of the weathering crusts is removed.

Browning of medieval stained glass

Apart from the extensively described corrosion (3 - 10) another type of corrosion can be observed: The glass darkens up to almost brown opacity, corrosion products seem to develop inside the glass. In some cases this type of corrosion occur on glass surfaces which seem to be absolutely unaffected. Examination of such glasses by means of optical microscopy reveals no homogenious staining as it would be in the case of solarisation. The surface is covered with an extremely fine network of cracks along which deep brown compounds are deposited.

Up till now no methods of restoring these browned glasses have been described. Since stained glass of high artistic value are disfigured by a strongly reduced transparency restoring the original appearance is of particular interest. For instance the early Romanic "Tree of Jesse"-window of St. Brigida at Legden in Westfalen has been so strongly altered that the colours were more or lessinvisible. During the restoration in 1965/67 the browned outsides of the glasses were removed by grinding and polishing. Apart from the problems involved with such a radical treatment the results were also unsatisfactory, because the painted inside could not be restored with the same method (11).

Formation of cracks in glass surfaces

Glass corrosion is caused by acids or bases (12, 13). At the first stage of acidic attack the alcali ions are replaced by protons. A high content of alcali makes medieval glasses extremely sensitive to acids. In context with the ion exchange reactions silicate gel layers are formed on the corroded glass surface. The structure of these gels differ from that of glass. In the case of loss-of-water due to changes of relative humidity in the surroundings, the volume-contraction of the gel causes a fine network of cracks (14).

In consequence of the ion exchange reaction only alcali ions are replaced, while the other components remain in the gel masses. Secondary reactions, under participation of atmospheric components (air pollutants), lead to different soluble and non soluble compounds. The soluble ones are washed away during weathering; the unsoluble remain of the glass surface forming the well known crusts.

In glass containing higher amounts of iron and manganese, oxides and oxide hydrates of Fe(3+), Mn(4+) and Mn(3+) can be formed while corrosion occur. These dark brown unsoluble compounds are deposed on the surface of the cracks (15), causing the browning effect.

Reaction of reducing agents with corroded glass

A method for removing these brown staining should aspire to a selective conversion of the brown compounds into soluble, respectively colourless ones. Reduction of the

$Fe(3+)$-, $Mn(4+)$- and $Mn(3+)$-ions to $Fe(2+)$- and $Mn(2+)$-ions yields the desired effect.

Small samples of discoloured medieval glass from Altenberg Cathedral (about 1380) were treated with some different reducing agents. The strong acidic solutions of $SnCl_2$ and $TiCl_3$ corroded the glass as well as a sodium dithionate solution. The reduction using a 24 % hydrazine hydroxide solution +) however has proved to be successful. After 2 - 10 hours treatment the brown oxides disappeared while the glass wasn't affected at all.

Leaching of medieval stained glass by bases

Hydrazine hydroxide is a weak base ($pK_b = 5.77$), the used 24 % solution has a pH-value of about 11. Since glass is generally not stable to bases, the degree of decomposition of the medieval glass from Altenberg by alcaline attack has been studied. Using grains of glass which remained between the sieves ASTM E 11-61 with 60 mesh/inch and 80 mesh/inch the leaching by different bases has been compared with that of hydrazine hydroxide. In the experiment were used 1,5 g of grains respectively; they were treated 90 hours at 20°C with different bases. After filtration, rinsing with water and drying, the residue was weighted. The weight difference was calculated relative to the total weight and to the surface. The results are listed in Table 1.

Table 1: Leaching of medieval glass from Altenberg (1380)

Base Concentration in weight %	Weight loss in %	Weight loss in mg/cm^2
NaOH, 20 %	0,86	0,057
NaOH, 10 %	0,69	0,046
NaOH, 5 %	0,68	0,045
NH_4OH, 10 %	0,59	0,039
NH_4OH, 5 %	0,48	0,032
N_2H_5OH, 24 %	0,24	0,017
H_2O (pH = 6)	0,51	0,034

Sodium hydroxide leaches glass very strongly. The durability of glass is much bigger, when ammonium hydroxide is used. Low concentrated ammonium hydroxide solution (5 %)

+) Hydraziniumhydroxid etwa 24 % N_2H_5OH reinst E. Merck, Darmstadt attacks glass to the same extent as weakly acidic deionized water (pH = 6).

The influence of the concentration of NaOH is obvious. In comparison to NaOH and NH_4OH the attack of hydrazine hydroxide on glass is negligable.

The reactivity of hydrazine hydroxide solutions increases, when their concentration is lowered. This effect is due to a very fast formation of a thin, but compact gel layer on the silicate surface, which hinders further alcaline attack The formation of such a layer has to be understood in connection with hydrogenbonds between the silicate and its surrounding medium (H_2O, N_2H_4). The 24 % hydrazine hydroxide solution causes a sufficient "passivation" of the gl[illegible] surface to further attack.

The influence of glass composition

The chemical durability of glass to hydrazine hydroxide in relation to the glass composition could not be determined in a series of leaching experiments using grains, because the available amounts of samples were to small. Fifteen samples of glass with different provenance, all which were browned (Table 2), were treated over a period of 48 hours with 24 % hydrazine hydroxide. After washing with water and drying with a towel the samples were examined by means of optical microscopy to see, whether they were damaged.

No damages could be observed; simultanously the dark brown colourof the iron- and manganese compounds disappeared in most of the samples nearly completely. The black stain as well as the crusts of the corrosion products on the glass surface remained unaffected. The latter turned from their grey, yellow or red colour to white, as the pollution with rust was also reduced.

Table 2: Glasses treated with hydrazine hydroxide

Dating	Provenance	Colour
1160/66	Soest, St. Patrokli	violet
1304/14	Köln, Dom	light blue
1330	Rothenburg o. Tb.	colourless
1340	Augsburg, Dom, Thron Salomon	amber
1340	Augsburg, Dom, Thron Salomon	violet
1379	Nürnberg, St. Sebald	amber
1380	Altenberg, Dom	light green
1415	Münnerstadt, Elisabeth-window	violet

Dating	Provenance	Colour
1420	Münnerstadt, Ritterkapelle	yellow
1420	Münnerstadt, Ritterkapelle	light violet
1420	Münnerstadt, Ritterkapelle	blue
1425/30	Iphofen, St. Veit	violet
1456	Nürnberg, St. Lorenz, Paumg.-w.	colourless
1495	Eichstätt, Holbein-window	light blue
1500	Landau, Hl. Kreuz	colourless

Restoration of browned glasses with hydrazine hydroxide

The reduction of iron, resp. manganese oxides and oxide hydrates with hydrazine hydroxide is a rather slow reaction. Therefore the browned glass should be treated with the reducing agent a longer period. The best result can be achieved when the corroded glass is immersed into the solution. The disadvantage is that the individual pieces of glass have to be dismanteled from the lead. Using a well wetted compress on the flat lying glass-window the results may be the same, but the duration of the treatment will surely be prolonged. Because of the fact that hydrazine catalytically decomposes, care should be taken to keep the agent reactive by changing the compress frequently.

Generally the treatment with hydrazine hydroxide should be kept as short as possible. No exact data can be given: the cleaning process should be stopped when the desired state is reached. After the glass is removed from the cleaning bath it has to be washed in running tap water.

If the browning is not affected within a 24 hours treatment, the cleaning process should be stopped.

Hydrazine hydroxide is a toxic compound. Above all the contact with skin should be avoided. The time handling with hydrazine hydroxide has to be kept as short as just necessary.

Literature

1. W. Geilmann, Beiträge zur Kenntnis alter Gläser V. Glastechn. Ber. 33(1960) 213 - 219.

2. R. G. Newton, The enigma of the layered crusts on some weathered glasses, a chronological account of the investigations. Archeometry 13, 1 (1971) 1 - 9.

3. R. G. Newton, The weathering of medieval stained glass J. Glass Studies 17 (1975) 161 - 168.

4. J. C. Ferrazzini, Reaction mechanism of corrosion of medieval glass. Conservation in Archeology and the Applied Arts. IIC Congress, Stockholm 1975, 135.

5. J. C. Ferrazzini, The influence of corrosion on the rate of decomposition on medieval glasses. Verre Réfract. 30 (1976) 26 - 29.

6. J. M. Bettembourg, Composition et alteration des verres de vitraux anciens. Verre Réfract. 30 (1976) 36 - 42.

7. R. Collongues, et. al., Nouveau aspects du phenomène de corrosion des vitraux anciens des églises francais. Verre Réfract. 30 (1976) 43 - 55.

8. R. Collongues, La corrosion des vitraux. Les Monuments Historiques de la France. No 1 (1977) 14 - 16.

9. J. Taralon, Problématique de la conservation et de la restauration des vitraux. Les Monuments Historiques de la France. No 1 (1977) 2 - 6, 97 - 100.

10. J. C. Ferrazzini, Die Einwirkung von Schwefeloxiden auf mittelalterliche Glasgemälde. VDI-Berichte Nr 314, (1978) 123 - 125.

11. U. D. Korn, Glasmalerei. In: Konservieren, Restaurieren. Katalog der Ausstellung im Westfälischen Landesmuseum Münster 1975, 91 - 107.

12. R. W. Douglas and T. M. M. El-Shamy, Reaction of glasses with aqueous solutions. J. Amer. Ceram. Soc. 50 (1967) 1 - 8.

13. D. M. Sanders and L. L. Hench, Mechanisms of Glass corrosion. J. Amer. Ceram. Soc. 56 (1973) 373 - 377.

14. R. H. Brill, Crizzling - a problem in glass conservation. Conservation in Archeology and the Applied Arts IIC Congress, Stockholm 1975, 121 - 131.

15. W. Geilmann, Beiträge zur Kenntnis alter Gläser VI. Glastechnische Berichte 33 (1960) 291 - 296.

81/20/6

TREE-RING CHRONOLOGY OF BEECH WOOD AND ITS APPLICATION IN THE DATING OF ART OBJECTS

P. Klein and J. Bauch

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Easel Paintings

TREE-RING CHRONOLOGY OF BEECH WOOD AND ITS APPLICATION IN THE DATING OF ART OBJECTS

P. Klein and J.Bauch

Stiftung Preussischer Kulturbesitz
Gemäldegalerie Berlin-Dahlem und Ordinariat für Holzbiologie
Universität Hamburg
Leuschnerstr. 91
2050 Hamburg 80
Fed. Rep. of Germany

Abstract

Thanks to the generous support by the VW - Foundation (Stiftung Volkswagenwerk) it was recently possible to establish extensive tree-ring chronologies for beech wood, which were successfully employed in the dating of panels of early german artists.
Individual boards of beech panels as have been used for instance by Lucas Cranach the Elder (1472-1553), frequently contain more than 150 annual rings, thus representing a sufficiently large period of time to allow for the relative and absolute dating of the panels. Alltogether 35 panels of this artist were investigated and assigned to their time of origin. The recurrence of certain characteristic ring sequences reveal that some panels had been assembled from boards of one and the same tree.
The technique employed in the manufacture of beech panels was different from that of contemporary oak panels in that sapwood was included regularly. This might give the art historian additional information as far as the accuracy of dating is concerned.

Introduction

Over nearly fifteen years (Bauch,1968) dendrochronological analyses were extended from archaeological and architectural objects to panels and woodcarvings and have proven a valuable aid in dating and localization of such objects. Besides the dendrochronological studies with oak panels of Dutch, Flemish, English and German artists between 1400 - 1900 (Bauch,Eckstein,1970; Eckstein et al.,1975; Bauch et al.,1978;Fletcher,1980;Klein,1981) also beech and lime panels of early german painters have been studied in the past three years (Klein,1979;Klein,Bauch,1981).

Making use of the experience gathered with oak panels dendrochronological dating is now being applied also to beech wood, a matter which shall be discussed in this paper. Since these investigations are still under way, the presentation must yet be considered of a preliminary nature. The final evaluation of the results shall be given at the 6th Triennial Meeting of the ICOM Committee for Conservation in September 1981.
Beech wood as a panel material was used almost exclusively by L.Cranch the Elder and his immediate associates (Cadorin, Veillon,1976). Notwithstanding the species differences the experience with beech wood may subsequently be transferred also to lime wood which was extensively employed by early german painters.

Basic approach to beech wood dendrochronology

In historical times beech wood was the rare exception with regard to its use in wood construction (Hollstein,1973). Hence it was so far impossible to establish a continuous chronology up to the present time -contrary to what has been reported repeatedly for oak- for dating beech panels. However, such dating was achieved in approximation by comparative analysis based on oak chronologies (Jazewitsch, 1953;Hollstein,1973). For this reason extensive initial cross-dating work had to be done to establish reliable statistical measures of chronological compatibility of recent beech within and between different sites and, subsequently, between beech and oak within the same site as well as over larger distances.
As a result, the mean chronological sequences (arithmetic average of several individual trees) of beech and oak from the same site proved compatible with the necessary degree of statistical confidence, notwithstanding the differences in structure and physiological behaviour of the two species This affirmative outcome of the initial investigation in turn permits the absolute dating of the mean chronological sequence established from the panels used by Lukas Cranach the Elder and his associates.

Application of the beech chronology

Up til now 30 individual boards from 15 paintings of the above mentioned artist were related to each other and dated in absolute terms. The evaluation of further 20 paintings, each assembled from up to 9 individual boards, is still in progress. Presently the beech chronology pieced together from such paintings -all signed and dated in the period of 1526-1533- comprises nearly 200 years.
In addition to the successful absolute dating the relative comparison between panels proved beyond doubt that individual boards were frequently taken from the same tree (Fig.1

Among the paintings constructed from boards of a single tree are the following:

- Lucretia, Gemäldegalerie Berlin-Dahlem, Kat.Nr.1832, signed 1533;
- Portrait of Martin Luther, Gemäldegalerie Berlin-Dahlem, Kat.Nr.617, classified;
- Portrait of Philipp Melanchthon, Gemäldegalerie Berlin-Dahlem, Kat.Nr.619, classified;
- The Ill-matched Lovers, Gemäldgalerie Berlin-Dahlem, Kat.Nr.1606, dated 1535;
- Portrait of Duke John Ernest of Saxony, Gemäldegalerie Berlin-Dahlem, Kat.Nr.II 55, classified;
- The Three Electors of Saxony: Frederic the Wise, John the Steadfast and John Frederic the Magnanimous, (left and right side), Kunsthalle Hamburg, Kat.Nr.606, classified.

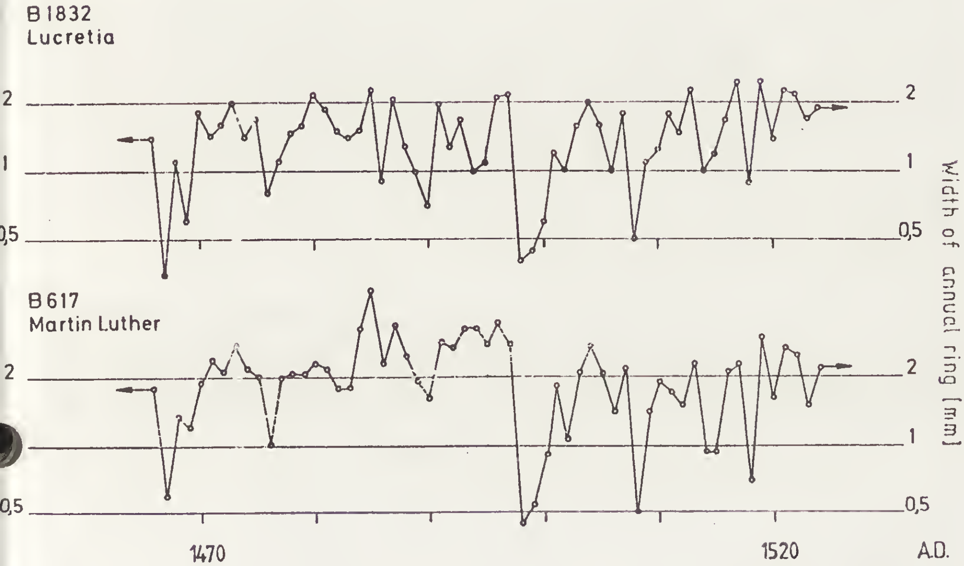


Fig. 1: Charts showing characteristic annual ring sequences of beech boards from the same tree.

Similary, a characteristic growth ring sequence of the boards joined for the paintings "Portrait of a Gentleman" Gemäldegalerie Berlin Dahlem, Kat.Nr.618, signed 1528 and "Portrait of a Young Girl" Louvre, Paris, Inv.Nr.1767, classified, showed then to be of the same tree. In this case the last growth ring could be dated to the year 1521.

Conclusions

From the investigations carried out so far it becomes evident that, with regard to the work of L.Cranach the Elder, the dating of his paintings is possible with a sufficient degree of accuracy. The determination of any given year, however, is limited to the last growth ring available for measurement. Any approximation of the felling date by extrapolating the estimated number of sapwood growth rings, as is commonly done with oak, is not considered feasible because beech does not develop a visibly differentiated sapwood. Only biological tests such as anlayses of starch, cell nuclei and enzymatic reactions will give an indication of the presence of physiologically active sapwood in beech. From the absolute dating, however, it may be assumed that for making the panels merely the bark was removed and the entire tree utilized. Any information about approximate periods of wood storage and drying can be given only after the final evaluation of the results from all paintings investigated (Klein,Bauch,1981).
Wood biological and dendrochronological analyses of recent beech wood have given proof for the compatability of growth ring patterns of beech and oak from the same site. This in turn has lead to the absolute dating of beech wood panels used by L.Cranch the Elder.By establishing a beech wood chronology similar dating procedures have become possible for lime wood, structurally and physiologically closely related to beech. This considerably widens the scope of tree-ring dating in its application to wooden art objects.

Acknowledgments

We are indebted to Prof.Dr.H.Bock,Gemäldegalerie Berlin-Dahlem for his active cooperation; to the VW-Foundation (Stiftung Volkswagenwerk) for its financial support; and Gemäldegalerie Berlin-Dahlem, Herzog-Anton-Ulrich Museum Braunschweig, Städelsches Kunstinstitut Frankfurt, Kunsthalle Hamburg,Staatliche Kunsthalle Karlsruhe, Alte Pinakothek München,Musée du Louvre Paris and Kunsthistorisches Museum Vienna for making available for investigation a large number of paintings.

References

Bauch,J.,1968,Kunstchronik, 144-145.
Bauch,J. and Eckstein,D.,1970, Studies in Conservation, 15, 45-50.
Bauch,J.,Eckstein,D. and Brauner,G.,1978, Jahrbuch der Berliner Museen, 20, 209-221.
Cadorin,P. and Veillon,M., 1976, in: Lukas Cranach: Gemälde,Zeichnungen,Druckgraphik, Basel 1974, 443.
Eckstein,D., Brongers,J.A. and Bauch,J., 1975, Tree-Ring Bulletin, 35, 1-13.

Fletcher,J.,1980, Proc. Royal Inst. of G.B. 52, 81-104.
Hollstein,E.,1973, Forstwisserschaftliches Centralblatt, 92, 47-50.
Jazewitsch,W.von,1953, Forstwissenschaftliches Centralblatt, 72, 234-247.
Klein,P.,1979, Holzzentralblatt 153, 2287-2288.
Klein,P.,1981, Jahrbuch der Berliner Museen, 23, in press.
Klein,P. and Bauch,J., 1981, Naturwissenschaftliche Rundschau, in prep.

SILICEOUS ARCHAEOLOGICAL MATERIALS

Coordinator : L. Vlad Borrelli (Italy)

Assistant coordinator: E. Porta (Spain)

Members : G. Biscontin (Italy)
S. Calogero (Italy)
V. Fassina (Italy)
J. Gautier (France)
R. Giachetti (Italy)
C. Lahanier (France)
L. Lazzarini (Italy)
F.G. Mavroyannakis (Greece)
C.M.Paleos (Greece)
C. Saldana (Spain)
C. Vincent (Switzerland)
G. Vindry (France)

Programme 1978-1981

1. Studies on the xylanes (Mavroyannakis, Paleos).
2. Salts extraction (Saldana, Porta).
3. Bricks and raw bricks (Italian group).
4. Thermoluminescence (Gautier).
5. Adhesives (Giachetti).
6. Bibliography (Saldana).

GROUPE DE TRAVAIL: MATERIAUX SILICEUX

Coordonnateur: Licia Vlad Borrelli
51, Via XXIV Maggio
00187 Roma
Italie

Les points sur lesquels on s'était proposé de articuler le travail de ce groupe étaient les suivants:
1) Théorie et méthodologie de la restauration des matériaux siliceux;
2) Bibliographie raisonnée;
3) Etude sur la technique de la dépose des mosaïques (supports, liants, protectifs, etc.);
4) Etude biologique sur la résistance des adhésifs et sur le developpement de la microflore sur les objets siliceux de fouille;
5) Etude chimique et physique sur les nouveaux consolidants et sur les nouveaux matériaux employés pour les supports et pour les intégrations des lacunes dans les matériaux siliceux.

Les études presentées à la réunion de Zagreb avaient touché aux problèmes de la conservation et de l'identification des matériaux. Les rapports qui suivent regardent:

a) Presentation d'une méthode de classification systématique de bibliographie sur la matière;
b) Mésuration de coéfficents d'expansion thermique d'anciennes terrescuites d'origine grecque;
c) Etude mineralogique et avec l'aide de la spectroscopie Mossbauer sur des céramiques à sgraffito d'époque byzantine dans la lagune de Vénise;
d) Nouvelle technique pour le prelief d'une section stratigraphique de terrain archéologique.

L'interêt du groupe s'est, donc, adressé plutôt à la recherche et à l'identification des matériaux qu'aux problèmes de la conservation. C'est le même phenomène qu'on vient de constater dans maintes autres études de ce comité. Il marque une inversion de tendence qui, si elle aurait étée souhaitable il y a quelques dizaine d'années, maintenant peut soulever certains soucis et surtout la crainte d'effacer ou de pousser en deuxième rang le but même du comité, c'est à dire l'examen des problèmes relatifs à la conservation.
On aurait en effet desiré, à côté de cette participation de representants des sciences de la nature, une égale présence de restaurateurs. l'équilibre du groupeen aurait gagné et l'éventail de problèmes qu'en serait decoulé aurait mieux répondu aux points qu'on s'était proposé de toucher.

AVANCE D'UNE BIBLIOGRAPHIE DE CONSERVATION ET RESTAURATION DE MATERIAUX SILICEUX

C. Saldaña de Goust

Comité pour la conservation de l'ICOM
6ème Réunion triennale
Ottawa 1981

Groupe de travail: Matériaux archéologiques siliceux

AVANCE D'UNE BIBLIOGRAPHIE DE CONSERVATION ET RESTAURATION DE MATERIAUX SILICEUX

C. Saldaña de Goust

Instituto de Conservación y Restauración de Obras de Arte
Avenida Reyes Católicos 6
Palacio de América
Madrid 3
Espagne

RÉSUMÉ

Présentation d'une méthode de classification systématique de bibliographie permettant la recherche soit par auteurs soit par thèmes concrets. A partir des classifications déjá présentées par ICOM et par IIC/Abstracts, nous avons étudié la possibilité de préparer une bibliographie sur les problémes de Restauration et Conservation de matériaux siliceux (Céramique et Verre). Nous sommes arrivés à la conclusion qu'il était nécessaire d'articuler cette bibliographie autour d'un cadre rigide et détaillé, tenant compte de toutes les spécialitées et sources nécessaires pour notre profession.

Cette bibliographie, donne la possibilité d'être augmentée facilement par un aussi grand nombre de fiches ou de thèmes au fur et à mesure de leur publication. En même temps, la classification numèrique permet son intégration directe à un programme d'ordinateur de bas prix offrant ainsi de nombreuses voies pour le futur. Nous avons classifié actuellement plus de 300 articles et présentons ici un nombre réduit de ces fiches afin de servir d'illustration à la méthode.

Elle est donc divisée en trois parties:

- Tout d'abord une relation en ordre numérique des fiches
- Deuxième partie, divisée en sept groupes qui permet la classification thématique.
- Une dernière partie avec un index alphabetique par auteurs.

TABLE DE MATIERES

INDEX NUMERIQUE

(F). 0001.- ICOM - CONSERVATION COMMITTEE
"Preprints for the triennial Meetings"
Venecia, 1975
Zagreb, 1978
1/11

(F). 0002.- PLENDERLEITH, H.J.
"The Conservation of Antiques and Works of Art". 2 nd. ed. Oxford University Press, London, 1974.
1/11; 3/31; 3/32

(F). 0003.- SEMINARIO REGIONAL LATINOAMERICANO DE CONSERVACIÓN Y RESTAURACIÓN, Mexico, 1973
1/11

(F). 0004.- UNESCO
"La préservation des biens culturels, notamment en milieu tropical". Musées et Monuments XI. (Publié également en anglais et en espagnol) 1969.
1/11; 3/31; 3/32

(F). 0005.- UNESCO
"Musées et recherches sur le terrain" Musées et Monuments XII. (Publié également en anglais
Paris, 1970
1/11; 1/13; 3/33

(F). 0006.- BRANDI, Cesare
"Teoria del Restauro" Edizioni Di Storia E Letteratura. Roma, 1963
1/12

(F). 0007.- IIC - CONSERVATION IN ARCHAEOLOGY AND THE APPLIED ARTS: "Preprints of the 1975 Stockholm Congress". London, 1975
1/12; 1/13; 3/31; 3/32

(F). 0008.- ATKINSON, R.J.
"Field Archaeology" (Methuen et Co. Ltd)
2ème ed. révisée.
1/13

(F). 0009.- WHEELER, M
"Archaeology from the Earth" Oxford University Press. London, 1954
1/13; 3/33

(F). 0010.- ICCROM - UNESCO
"Worldwide Problems in the Training of Specialists in Conservation" Working Document, Re-

commendations and Sumary of an International
Meeting on Training in 1976. Document: UNESCO
SHC 76 Conf. 643/2 Paris. June 1976
1/14

(F). 0011.- PHILIPPOT, P
"Ensayo de Tipología sobre la Formación de Especialistas de la Conservación" 1er Serlacor
Documentos de Trabajo Seminario Regional Latinoamericano de Conservación y Restauración.
Mexico, 1973
1/14

(F). 0012.- BLANC, A
"Les Techniques utilisées dans les grands ateliers de potiers dans l'Antiquité" Revue Archeologique de l'Est et du Centre-Est, XIV
Vol. 4. p. 267, Dijon, 1963.
2/21; 2/22

(F). 0013.- FRODL - KRAFT, Eva
"Le vitrail médieval, technique et esthetique
Cahiers de Civilisation Médieval Xe - XIIe S.
anné X nº 1 (Janvier-Marz 1967)
2/22

(F). 0014.- SINGER, F et SINGER, Sonja S.
"Industrial Ceramics" Chapman & Hall Ltd. London, 1963
2/22

(F). 0015.- HONEY, W.B.
"European ceramic art" from the end of the
Middle Ages to about 1815. Ed. Faber and Faber Ltd. London (sans date)
2/23

(F). 0016.- ANDRE, Jean - Michel
"Restauration de la Céramique et du Verre".
Office du Livre. Fribourg. Société Française
du Livre, 1976
3/32

(F). 0017.- CORPUS VITREARUM MEDII AEVI (CVMA)
"Technical Committee, Answers to the questionnaire on the conservation of windows" 7th.
Conference Florence, 2-6 october, 1970.
3/32

(F). 0018.- JACOBI, R
"Die Konservierung alter Glasmalereien" St.
Lucas, 11 (1957). pp. 186-192
3/32

(F). 0019.- LARNEY, J
"Restoring Ceramics" Barrie & Jenkins, London, 1975.
3/32

(F). 0020.- S. MESEGUER, José
"La Conservación de la cerámica, método y técnica" Miscelania de Arqueología, XXV Anivers. Cursos Internacionales Ampurias.(1947-1971) Separata T.II. 1974, Barcelona. Diputación Provincial Instituto de Prehistoria y Arqueologia. pp. 329-337.
3/32; 3/33

(F). 0021.- WERNER, A.E.A.
"Problems in the conservation of glass" Ann, 1er Congrès des Journées Internationales du Verre. Liege, 1958, pp. 189-205
3/32

(F). 0022.- ANON
"Adhesives" Mach. Des. 48, nº 26. pp. 155 (1976) also Rubber & Plastics Research Association of Great Britain Abstracts, Shawbury 14 nº 19, Abstract 7703414L (1977)
3/34

(F). 0023.- BRILL, R.H.
"The scientific investigation of ancient glasses" Proceedings of the Eighth International Congress on glass. London, 1968. pp . 47-68. Incipient crizzling in some early glasses, Bulletin of the American Group of the International Institute for Conservation of Historic and Artistic Works, 12 (1972)
4

(F). 0024.- INTERNATIONAL CONFERENCE ON THE APPLICATION OF NUCLEAR METHODS IN THE FIELD OF WORKS OF ART. Rome, Venice, Mai 24, 29 (1973)
4

(F). 0025.- ART AND ARCHAEOLOGY TECHNICAL ABSTRACT (AATA) Published semi-annually at the Institute of Fine Arts, New York University, for the International Insvitute for Conservation of Historic and Artistic Works,. Ed. Office:c/o New York University. Conservation Center Institute of Fine Arts. 1 East 78 th Street. New York, 10021. (Jusqu'a 1980)
5/51

(F). 0026.- BOLETIN DE LA SOCIEDAD ESPAÑOLA DE CERAMICA
c/ Serrano, 113 (Madrid) - 6 . España.
5/52; 7/72

(F). 0027.- VON IMHOFF, H.C.
"A Basic Bibliography of Conservation. The Literature on Conservation and Restoration of Art and Archaeology" Preliminary Edition, 1978. with Appendix A & B. Ref. 78/0/0, Zagreb, 1978, ICOM
6/61

(F). 0028.- HEDVALL, J.A.; JAGITSCH, R. et OLSON, G.
"Bibliographie Technique fabrication verre"
6/62 (sans date)

(F). 0029.- BECKSMANN, R
"Bibliographie zur Technik und Restaurierung von Glasmalereien" Preliminary edtion. Arbeitsstelle Corpus Vitrearum Medii Aevi. Stuttgart - 1972.
6/63

(F). 0030.- CONSERVATION DIVISION NHPS. (Parks Canada INA). "Conservation of Archaeological Ceramics" 1570 Liverpoolcourt Ottawa Ont. KIA OH4
6/63

(F). 0031.- NEWTON, R.G.
"Critical Bibliography on the Study of the deterioration and the conservation of stained windows" For the British Academy Published by the Oxford University Press, Oxford, 1974. (samblable AATA Vol. 10 nº 2)
6/63

(F). 0032.- ROME CENTER
"Bibliographie- Vitraux" ICCROM, 13 via S. Michele 00153 ROME (sans date)
6/63

(F). 0033.- GAUDEL, P
"Bibliographie der archaeologischen Konser--vierungstechnik". Ergaenzungsband des Berliner Jahrbuches fuer Vor - und Fruehgeschichte, Bd. 2, 1969 (2. Auflage), Berlin.
6/64

(F). 0034.- SAYRE, E.V. et MEYERS, P
"Nuclear activation applied to materials of art and archaeology" annotation. AATA Vol. 8 nº 4. 71.
6/65

(F). 0035.- BOLLETINO DELL 'ISTITUTO CENTRALE DEL RESTAURO. Piazza S. Francesco di Paola, 9. 00184. Rome (Italie)
7/71

(F). 0036.- ANNALES DU LABORATOIRE DE RECHERCHE DES MUSÉES DE FRANCE. 10, rue de l'Abbaye, 75006 Paris (France)
7/71

(F). 0037.- BULLETIN DE L'INSTITUT ROYAL DU PATRIMOINE ARTISTIQUE. One Parc du Cinquantenaire BI040 Bruxelles (Belgique)
7/71

(F). 0038.- CCI
The Journal of the Canadian Conservation Institue The National Museums of Canada, 1030 innesroad. Ottawa. Canada. KIA OM8
7/71

(F). 0039.- INFORMES Y TRABAJOS DEL INSTITUTO DE CONSERVACION Y RESTAURACION DE OBRAS DE ARTE. Avdª Reyes Católicos, 6 Madrid - 3 (Espagne)
7/71

(F). 0040.- NEWSLETTER/CHRONIQUE ICCROM
International Center for the Study of the Preservation and the Restoration of Cultural Property. 13 via S. Michele 00153, Rome (Italie)
7/71

(F). 0041.- STUDIES IN CONSERVATION
International Institute for Conservation of Historic and Artistic Works. 6 Buckingham Street. London WC2N. 6BA. GB.
7/71

(F). 0042.- ANTIQUARIES JOURNAL
Oxford University Press, Press Road. Neasden, London NW 10 et 200 Madison Ave. New York. N. Y. 10016, U.S.A.
7/72

(F). 0043.- JOURNAL OF GLASS STUDIES
Corning Museum of Glass. Corning. N.Y. 14832 U.S.A.
7/72

(F). 0044.- LA CÉRAMIQUE MODERNE
22, rue Le Bru, 75013 Paris (France)
7/72

CLASSIFICATION THEMATIQUE

INDEX ALPHABETIQUE PAR AUTEURS

81/21/1-10

81/21/2

PRELIMINARY MEASUREMENTS OF THERMAL EXPANSION COEFFICIENT OF ANCIENT TERRACOTTAS

E.G.Mavroyannakis

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Siliceous Archaeological Materials

PRELIMINARY MEASUREMENTS OF THERMAL EXPANSION COEFFICIENT OF ANCIENT TERRACOTTAS

E.G.Mavroyannakis

Nuclear Research Center Democritos
Athens
Greece

Abstract

Thermal expansion is an important physical property of fireclays,as it is directly related to their thermal ageing behavior. As every operation on materials for conservation purposes affects more or less their properties,it is necessary to know thermal expansion in order to avoid astonishing situations after treatement. However,thermal expansion is of more general importance concerning degradation even in cases where chemical and biological processes are prevented.

In this peper preliminary results on the thermal expansion coefficient are reported,and the importance of further development of thermal analysis is pointed out .

Introduction

Thermal properties of fireclays are very important as they give information on the material structure and composition. These properties chenge,however, following transformation and degradation processes of materials. Resulting changes of the fireclay thermal properties may be also attributed to processes of the production and firing technologies.

The purpose of this paper is to present preliminary results of measurement of thermal expansion coefficient of ancient terracottas of Greek origin, and compare them with modern material. We have used potsherds coming from various parts of Greece as shown in Fig.I. These terracottas are even of various eras as shown in Table I,and to our knowledge thermal expansion measurements have not been done up to now .

Table I

Potsherd's era	Origin
Minoan	Crete:Festos, Arhanes,Fourni
Classic	Olympia
Byzantine	Stylis
Modern (Maroussi)	Amaroussion: Athens

Thermal Expansion

Thermal expansion is a function of the following characteristics of fireclays :

(a) composition and structure of the raw material used for the production of the clay,
(b) production technology of the clay as well as of the unfired objects,
(c) firing processes and technology,
(d) weathering of fireclays.

All processes change to a higher or lower degree thermal expansion. However,processes changing porosity allow more freedom to the fireclay grains to expand


YUG.
BUL.
ALB.
TUR.
ST.
AM.
OL.
FE.
AR.
AR.. Arhanes
FE.. Festos
MA.. Maroussi
OL.. Olympia
ST.. Stylis
ΕΛΛΑΣ

Fig.1

during heating without changes of the volume. As fireclays become more dense dimensional changes are more important,and the expansion coefficient is increased . Conversely,as porosity increases the thermal expansion coefficient must decrease. Pore size, shape,filling conditions affect greately thermal expansion. Porosity is however a function of all characteristics mentioned above. In any case,thermal expansion may be used as a physical parameter of the fireclays,and may bring out unknown details and valuable information .

Due to the considerable number of parameters affecting thermal expansion,further work is needed for developing this method of analysis .

Thermal Expansion Coefficient

The thermal expansion coefficient is thermodynamically defined as follows :

(I) $$a = \frac{I}{V}\left(\frac{\partial V}{\partial T}\right)_p ,$$

where V is the volume,T absolute temperature and p pressure (held constant). a is the volume expansion coefficient related to the linear expansion coefficient a_l by the well known relation

(2) $$a_l = \frac{a}{3} .$$

The coefficient a_l is related to the compressibility K and the heat capacity C by the Grüneisen relation

(3) $$a_l = \frac{\gamma CK}{-3} ,$$

where γ is the Grüneisen parameter independent of temperature,and ranging between I and 2 for different materials.

It is to be mentioned that heat capacity and compressibility depend on the composition and the structure of the material .

In our case we have measured a_l by using a Perkin-Elmer TMA system and samples of small dimensions like 5X5X5mm and less than 4 grs of weight.

For calculations,expression (I) is not a linear function of temperature, however a_1 is a weak function of temperature and can be reduced to the known form :

$$a_1 = \frac{1}{L_o} \cdot \frac{\Delta L}{\Delta \theta} \quad , \tag{4}$$

where L_o is the initial thickness and ΔL its variation for $\Delta\theta = \Delta T$ temperature increase .

In the measurements we have used the following heating-cooling program :

Minimum temperature	25^oC,
Maximum temperature	300^oC,
Heating rate	$5^oC/min$,
Cooling rate	$5^oC/min$.

The temperature range $25-300^oC$ has been devided into three consecutive ranges: 25-IOO, IOO-200, $200-300^oC$, in order to be able to apply the relation (4) in a linear range. for good statistical results we have used 3 to 4 pieces from each potsherd, performing 3 to 5 runs for each one according to the above program .

Experimental Results

We have measured for each temperature range and sample the avarege expansion coefficient by performing a number of runs as in Table II . The first heating run for each piece has not been taken into account, as the moisture of the sample affects greatly the expansion processes. After the first run terracottas are well stabilizedand measurements may be performed. The thermal expansion coefficient as well as the root mean square error is given in the Table II. It is important to note that pieces of terracottas measured belong to the same potsherd taken by chance from a lot of them . More work is therefore needed to find representative terracottas from each area and define the thermal expansion coefficient. So, it will be probably possible to confirm if differences resulting from Table II are really characteristics of each area, technology trend etc. We believe that correlation with the porosity may give better information. We are

Table II

Origin	Runs	a_l X10^{-6}		
		25-100°C	100-200°C	200-300°C
Arhanes	10	5,6 ±0,4	6,8±0,3	8,1±0,3
Fourni	9	4,4 ±0,3	5,6±0,3	7,5±0,5
Festos	11	5,2 ±0,4	6,2±0,7	8,4±0,3
Olympia	14	7,0 ±0,6	6,8±0,3	6,6±0,6
Stylis	10	6,2 ±0,6	6,6±0,3	8,0±0,4
Maroussi	20	6,8 ±0,4	7,5±0,6	8,7±0,8

actually working on this problem,hoping that we would soon be able to have results for a first correlation with thermal expansion .

It has been found that ΔL is not a linear function of temperature as shown in Fig2.

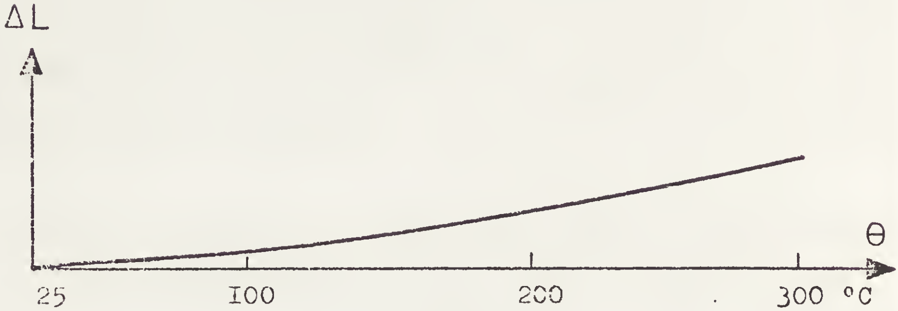


Fig.I

Concluding Remark

On the base of preliminary results of the thermal expansion coefficient, differences exist for terracottas of various origin. However, we bilieve that it is too early to advance any proposition,before measuring porosity and expansion coefficient for higher temperatures,and other thermal analysis programs.

Acknowledgements: The author is indebted to Mr A.Antonopoulos and A.Kokkinos for their assistance.

81/21/3

PRELIMINARY CHEMICAL, MINERALOGICAL AND MÖSSBAUER STUDIES OF EARLY BYZANTINE SGRAFFITO CERAMICS FROM THE LAGOON OF VENICE

S. Calogero, L. Lazzarini, A. Marigo
and V. Visentini

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Siliceous Archaeological Materials

PRELIMINARY CHEMICAL, MINERALOGICAL AND MÖSSBAUER STUDIES OF EARLY BYZANTINE SGRAFFITO CERAMICS FROM THE LAGOON OF VENICE

S. Calogero, L. Lazzarini, A. Marigo and V. Visentini

S. Calogero, ICTR-CNR, Corso Stati Uniti, 35100-Padua, Italy

L. Lazzarini, Scientific Laboratory of the Soprintendenza ai Beni Artistici e Storici di Venezia, Dorsoduro 170, 30100-Venice, Italy

A. Marigo, Istituto di Chimica Generale, Università di Padova, Padua, Italy

V. Visentini, Istituto di Fisica, Università di Padova, Padua, Italy

Abstract

A systematic research about a large number of well authenticated Byzantine sgraffito ceramics found in the Lagoon of Venice has been performed. The employed materials have been studied by chemical, mineralogical and Mössbauer techniques. Some preliminary results seem to indicate that the early Venetian sgraffito ceramics are an imitation of the Byzantine pieces arriving at the market of Venice from the Byzantium Empire.

Introduction

Venice in the Medieval times has always been tightly connected with Byzantium not only for its traffics and commerces, but also artistically. The golden age of the artistic production, influenced by Byzantine art in Venice, is the XI - XIII Centuries, when many Costantinopolitan artists and artisans are present in the islands of the Lagoon. In this period, besides the world famous mosaics of Torcello, Murano and Venice, many masterpieces of sculpture, metalwork and jewellery are produced. In these centuries there is a massive importation of artistic objects from the Capital of the Empire, which reaches its maximum with the capture of Costantinople during the IV Crusade (1204) and the consequent great pillage made by Venetians. To the thousands of objects arrived to Venice, many of which can still be found or seen in its monuments and museums, many fragments of early sgraffito ceramics that stll bring to light erratically from the Lagoon are to be added. These sherds, whose date range from the end of the XI to the first half of the XIII C.(Talbot Rice, 1930), are extremely important for the beginning of the Venetian production of sgraffito ceramics, which reached a very high qualitative and quantitative standard of production during the Renaissance.

A complete history of Venetian ceramic art has not yet been written because of a lack of data and information about the early products, mainly due to the absence of excavations, very difficult in the lagunar environment. In fact even the very serious campaign conducted at Torcello in 1961-62 by a Polish team of archaeologists (Leciejewiçz et al., 1977) did not clarify enough this problem.Their hypothesis on the Roman heritage in the ceramic manifacture is surely valid for the High Middle Age, but the beginning of the local sgraffito production, already in the XII C., must be demonstrated by more convincing arguments. So, up to now, the positive possibility to trace the origin and the evolution of the sgraffito seems not to exist and first an importation and later a local imitation of the sgraffito technique may be hypothezed (Lazzarini et al., 1981). The findings of sherds showing typical Byzantine characteristics confirm this more probable hypothesis which must nevertheless be concretely proved.

Having already performed a study on Venetian sgraffito ceramics of the Renaissance period (Lazzarini et al., 1980) we have thought interesting to submit to scientific investigation not only some imported sherds but also other sherds that may be considered as the first examples of local Venetian prodiction on imitation of the Byzantine style.These last sherds have been selected among those showing intermediate characteristics between the early Byzantine and early Venetian sgraffito ceramic, which are dated to the second half of the XIV C. (Lazzarini et al., 1981).

The purpose of the study is to confirm the importation and the hypothetical beginning of the manifacture in Venice, by various types of analysis, and to compare the results with those of Venetian sherds of the XV and XVI C. previously reported (Lazzarini et al, 1980).

FULL DESCRIPTION OF POTSHERDS

Pink Torcello

B1: Bottom of little bowl with white engobe and yellow glaze;marks of scratches;XII C.

B2: Bottom and wall of little plate with white engobe and yellow glaze; scratched by a thin tip; XII C.

B3: Plate with white engobe and yellow glaze; scratched by a thin tip; XII C.

B4: Wall and edge of little bowl with green glaze; scratched by a thin tip; XIII or XIV C.

B5: Wall of little plate with engobe and yellow glaze; scratched by a thick tip; XII C.

B6: Fragment of little plate (?); light-brown glaze with little dots of white engobe; XII C.

S.Arian

B7: Plate scratched by a thin tip; yellow glaze with decoration; XII C.

Museum of Bassano

B8: Bottom of little bowl; scratched by a point-shaped decoration; the drawing shows a bird turned on the left and a leaf or a poplar;XIII C. (?)

Fusina

B9: Bottom of plate; triangles scratched by a thick tip with decoration; yellowish glaze by the ' ferraccia ' pigment; XIII C. (?)

B10:Like B9 but decorated by concentric circles; yellow decoration; XIII C. (?)

S. Leonardo in Fossa Mala

VB1: Thick plate; thick ceramic body without engobe; a spiral motif is scratched on the ceramic body; dark-green glaze; XIV C.

VB2: Like VB1; plate engobed; a geometrical motif is scratched; imitation of Byzantine models; marks of brown glaze; XIV C.

Description of Potsherds

All the potsherds belong to open forms: dishes or small bowls, have or had a white slip covering the ceramic body and a transparent, sometime yellowish,glaze. The decorations, impressed by the sgraffito technique, are very simple,mostly floreal or geometric, of the type illustrated in the plate XIII of Talbot Rice's book. They date to the late XI or XII C.; only the samples B9 and B10 may be little later in date. The samples VB1 and VB2 show motifs different from the typical early Byzantine sgraffito and must be more ancient than the half of the XIV C. because they have been found at S.Leonardo in Fossa Mala, an island deserted after that date.

It has been possible to sacrifice some samples for destructive analyses owing to their small dimensions (a few square cm) and their low artistical value, even if of great historical importance and rarity.(Their frequency in the Venetian terrains is 1:5000 with respect to the total ceramic fragments superficially found).

Experimental

Only the samples B1, B2, B3, B4, B5 and B7 were studied on thin cross-section by a mineralogical microscope. The remaining samples are too precious to be cut!

Diffractometric and chemical analyses were carried out on ceramic bodies. The first with a Cu K_{α} radiation (40 kV, 20 mA), the latter using an XRF energy dispersive spectrometer, with a Mo anode(15 kV, 100 μA, energy range 0-10 keV, live-time 400 s). Only the Magnesium was determined by atomic absorption photometry. The ignition loss has been determined at 1000°.

The non-destructive conversion X-ray Mössbauer scattering (CXMS) technique has been used in order to study the glaze of the painted ceramics. The interested thickness is about 10 μ .

Transmission Mössbauer spectroscopy has been used in order to study the ceramic body. The source, ^{57}Co(Rh), has been always kept at 95 K in a cryostat with a vertical beam geometry while the samples were studied at variable temperature, between 77 and 300 K.

Chemical Analysis, expressed in the oxide form (wt%).

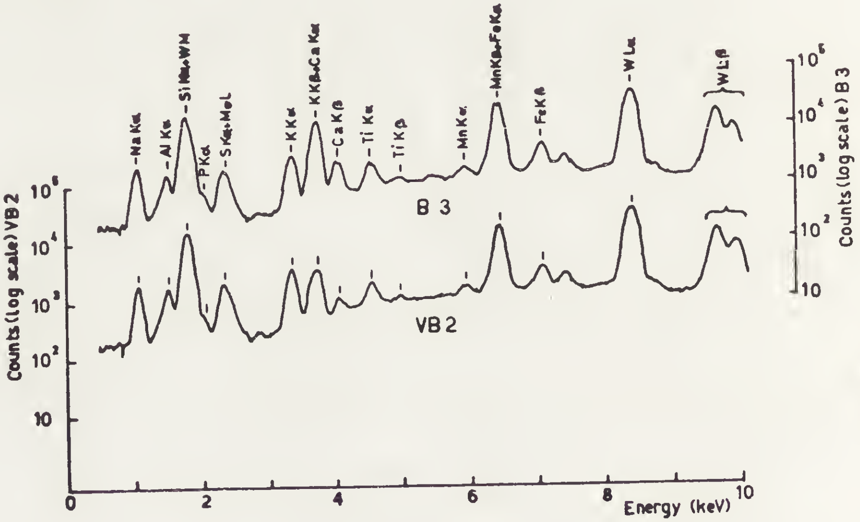
Provenance	Sample	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ignition Loss
Torcello	B1	58.32	14.64	7.19	2.59	9.26	2.61	1.92	0.76	0.76	0.10	3.98
Torcello	B2	57.16	13.80	8.13	4.78	8.96	2.82	2.12	0.76	0.30	0.11	1.43
Torcello	B3	51.71	16.78	8.89	4.08	11.61	2.15	2.65	0.82	0.73	0.12	4.01
Torcello	B4	61.66	18.50	6.68	2.50	1.70	2.36	3.50	0.82	0.21	0.10	2.09
Torcello	B5	60.34	18.64	7.24	2.46	3.48	2.23	3.17	0.88	0.22	0.11	2.34
S.Arian	B7	54.56	21.15	8.16	2.48	6.32	1.47	3.52	0.91	0.25	0.12	3.02
Bassano	B8	60.86	17.64	7.11	2.89	4.26	2.59	2.66	0.98	0.36	0.13	2.70
(Castle of Ezzelino)												
Fusina	B9	58.33	16.51	7.76	3.59	6.35	2.45	2.67	0.90	0.19	0.10	2.47
Fusina	B10	50.31	13.64	5.85	3.35	18.62	2.14	1.66	0.71	0.27	0.05	4.10
S.Leonardo	VB1	56.66	20.12	7.37	2.90	5.59	1.98	3.63	0.71	0.28	0.14	4.35
S.Leonardo	VB2	58.72	21.40	6.74	2.68	3.08	1.74	3.80	0.72	0.22	0.12	3.56

Chemical Analysis

The percentual composition, expressed in the oxide form, of the sgraffito Byzantine sherds together with the samples VB1 and VB2 found at S.Leonardo in Fossa Mala are beside reported. A remarkable homogeneity is observed between the samples B1 and B2 on one hand and B4 and B9 on the other. The composition of the ceramic bodies B3 and B10 is unlike showing that the clays were extracted from different places. A large ignition loss is presented from the samples B1, B3, B10, VB1 and VB2.

Even if it is difficult to compare directly this type of data, it is undoubted that only the chemical analyses of S.Leonardo in Fossa Mala are close to the Venetian ones of the XV and XVI C. (Lazzarini et.al., 1980).

In Figure the logarithmic plot of the XRF analysis for the sample B3 together with that of sample VB2 are reported for comparison purposes.



Mineralogical Analyses

The samples B1 and B3 have a brown paste, typical of a reducing atmosphere while the remaining ones have a red ceramic body indicating an owen with an oxidative atmosphere. All the samples show a porphyric-hypocrystalline structure, with a variable amount of vitrified groundmass (high in B1 and B2, average or low in the remaining samples),and show very different grain size among the minerals of the sandy skeleton.

The sample B1 has a good porosity, fenocrystals of large size, made of quartz and feldspar, frequently polycrystalline, with sharp edges. Very important is the presence of calcite not only in few recognizable crystals but also in many nodules where it appears modified by the baking conditions and with clear signs of decomposition. This indicates that the probable firing temperature is 900-950° C against a temperature between 1000 and 1100° argued from the Venetian ceramics. The presence of calcite nodules,responsible for breakage and rupture during the baking, indicates the use of undepurated or unseasoned clay in contrast with the Venetian procedure (Lazzarini et al., 1980). Mullite, present in thiny needles, is not very abundant in agreement with the low baking temperature. Opaque or semi-opaque minerals, mostly of haematitic composition, are also identifiable. The white slip appears as a mass of highly birefractive small needles and prisms of quartz, with few opaque particles. Its average thickness is about 120 μ. The glaze is colourless and fractured.

The sample B2 is very different from B1: the sandy skeleton is more abundant, but of a smaller grain size. Quartz, feldspar and plagioclase are more corroded along the boundaries. There is not trace of calcite, while the mullite, much more abundant and well iso-oriented even if not well grown, points to a higher firing temperature in comparison with B1.

The sample B3 looks different from B1 and B2. It seems more vitrified, with extremely fine grains, few fenocrystals of quartz and feldspar, many crystals of calcite and small mullitic needles. The white slip is thin (60-70 μ), while very little of the glaze has survived to the sandy abrasion and to sea-water corrosion.

The samples B4 and B5 are very similar to B2 even if B4 contains trace of muscovite. The white slip in B5 is 70-80 μ thick, one and a half time the glaze thickness.

The sample B7 contains big silicate fragments of quartzite perhaps added to clay as an extender. Calcite nodules and mullite are also abundant.

The mineralogical characteristics of the samples VB1 and VB2 are very close to the Venetian sample ones previously described (Lazzarini et al., 1980). As expected, the lack of uniformity in the mineralogical analyses of Byzantine potsherds in comparison with the Venetians indicates a various provenance of the Byzantine clays.

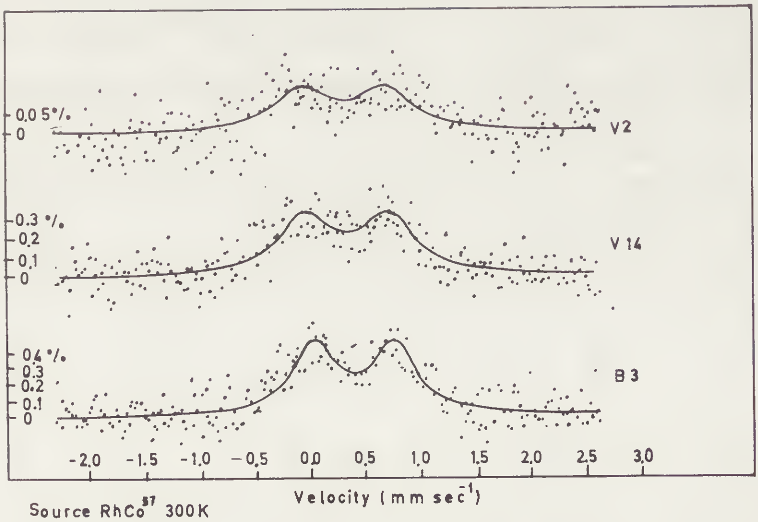
The diffractometric results were not sensible enough to differentiate the various sherds. In addition to the ubiquitous quartz, felspar and plagioclase, the analyses showed the presence of calcite in the samples B1, B2 and B10 and the haematitic lines in B2.

Mössbauer Results

The Mössbauer spectra of the Byzantine ceramic bodies are in general less complex than the Venetian ones (Lazzarini et al., 1980). They consist of a superposition of a quadrupole doublet with a six-line magnetic component. A large diversity in the relative intensity of the two components is observed, in particular between the sample B4 and the others. As previously reported the doublet may be considered as the resultant of the component due to the paramagnetic structural iron(III) with the component due to the superparamagnetic α-Fe_2O_3 in small particles. The sextet due to the relatively large particles of α - Fe_2O_3 exhibits in general a hyperfine magnetic value smaller than that of the pure α - Fe_2O_3. This is perhaps due to the formation of non-stoichiometric oxides of type ($Fe_{1-x}Al_x)_2O_3$.

Unlike Mössbauer spectra of Venetian and Paduan sherds no iron (II) component is present in the Mössbauer spectra of Byzantine pottery even if the brown paste of B1 and B3 is typical of a reducing atmosphere in the baking. Unlike Venetian spectra no magnetite is present in the Byzantine samples.

The CXMS spectrum obtained from the glaze of the sample B3 is reported together with that of V2 (a Fusina fragment of plate decorated by branches, XV C.) and V14 (a Sant'Erasmo fragment of plate decorated by a sgraffito floral ornament, half of the XVI C.).



The CXMS parameters for the samples V2 and V14 are identical but different from the corresponding ones of B3. So the pigment used from the ' boccalari ' or ' scodellari ' in Venice was different from that used from the jug- and bowl-makers in Costantinople even if in both the cases the yellow pigments contain iron(III).

Conclusion

Even if this study is still incomplete and other potsherds,found together with kiln waste products and leftovers in Venice, Greece and Turkey,must be investigated,a general conclusion may be done.

The hypothesis of the Roman heritage, affecting the early Venetian sgraffito ceramics (Leciejewiçz et al., 1977), even if suggestive, is inconsistent not only with macroscopical observations or stylistic and typological considerations (Lazzarini et al., 1981), but also with the present chemical, mineralogical and Mössbauer investigations carried out on a large number of well authenticated potsherds. On the contrary the Venetian sgraffito art was strongly influenced by the Byzantine pieces arriving at the market of Venice from the Byzantium Empire. The quickly spread of the sgraffito art into the West, after the fall of the Byzantium Empire, is due to the wonderful production of Venice and Padua, soon become very important centres of exportation of standard and fine wares.

References

- D.Talbot-Rice (1930), Byzantine glazed pottery, Oxford.
- L.Leciejewiçz, E.Tabaczynska, S.Tabaczynski (1977), Torcello, Scavi 1961-62, Roma.
- L.Lazzarini, S.Calogero, N.Burriesci, M.Petrera (1980), Chemical, Mineralogical and Mössbauer studies of Venetian and Paduan Renaissance Sgraffito Ceramics, Archaeometry, 22, 1, 57-68.
- L.Lazzarini and E.Canal(1981), Studi Veneziani,Fondazione Cini, in press.

81/21/4

A NEW TECHNIQUE FOR THE REMOVAL OF STRATIGRAPHIC SECTIONS IN ARCHAEOLOGY

M. Sawada

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Siliceous Archaeological Materials

A NEW TECHNIQUE FOR THE REMOVAL OF STRATIGRAPHIC SECTIONS IN ARCHAEOLOGY

M. Sawada

Nara National Cultural Properties Research Institute
2-9-1, Nijo-cho
Nara-shi 630
Japan

ABSTRACT

The removal of 'stratigraphic sections', or 'sedimentary peels' from earth surfaces has been used by geologists from almost 100 years. More recently, it has been applied to the field of archaeology where it has found many applications. It is a useful method for studying and preserving the stratigraphy of an excavation away from the site. It is also useful in the context of a museum or educational display to explain the work of the archaeologist.

While a number of adhesives have been suggested for use in taking such sections[1], none have proven successful under the field conditions found in Japan. In particular, cellulose nitrate, an adhesive used for making sections in Europe, was unsuccessfully applied to the dense and moist earth sections frequently found at Japanese excavation sites. This paper will outline a set of procedures, and describe a specially

formulated adhesive, used to make stratigraphic sections in Japan. The successful results of this work can be applied to most field conditions found throughout the world.

I. Site Preparation:

A level horizontal or vertical earth surface is carefu prepared. This represents the back of the stratigraphic section against which the adhesive and support will be attached.

II. Pretreatment for Soil with a High Moisture Content:

If the moisture content of the soil is below 30%, it c be treated directly with epoxy, as discussed in Step III. If the moisture content is above 30%, the water will inhibi the polymerization of the epoxy and an intermediate step mu first be applied. This involves the spray application of a water-activated isocyanate solution directly to the earth surface; approximately 400 grams per square meter is recommended. If an excessive amount of isocyanate is used on a very porouse material such as sandstone, a deep impregnation will result, causing the removal of too deep a section. The isocyanate is activated by the water in the soil, and creates a thin film which adheres the particles of soil, stone, etc. together.

III. Application of Backing Materials:

If the moisture content of the soil is 30% or below, or after the erath section has been treated with isocyanate, it is ready to recieve a 'prime coat' of a specially prepared epoxy resin, refered to as TOMACK NR-51. This epoxy exhibits greater flexibility and adhesive strength than cellulose nitrate. It is especially appropriate for the three general soil conditions found at Japanese excavation sites, shell mounds, earth mounds, and alluvial soil. The increased adhesive strength is especially important when sampling sites with pounded earth layers, such as are encountered in the floors of dwellings. Such dense layers are very hard and difficult to remove intact.

The epoxy is a three component adhesive consisting of: 1) Araldite Epoxy GY250 mixed with AEROGEL, an antisagging agent consisting of fumed silica, necessary for working on vertical surfaces, CALCIUM CARBONATE, to improve adhesive strength, EPONIT, and NONYLPHENOL, an epoxy thinner (5 parts), 2) Araldite Hardener HY837 (1 part); Hardeners HY830 and HY850 can also be used to vary the gel time between three and twelve hours, 3) Syntaron, a modified phenolic compound, used to plasticize the epoxy; flexibility is important when peeling the section away from the earth (1 part).

The flexibility of the resin can be increased by adding more Syntaron, such as when the stratigraphic section is to be stored in a rolled state. However, this is not advisable because of the risk of destroying the clear boundaries between layers and because of the rigidity of many of the layers.

The first coat of epoxy can be sprayed on or applied with a brush. After the epoxy has hardened, starch-free cheese cloth made of cotten and hemp is attached with an additional layer of epoxy. This cloth is softer and conform to the contour of the substructure more easily than fiberglass cloth. It is also lightweight and inexpensive.

IV. Section Removal:

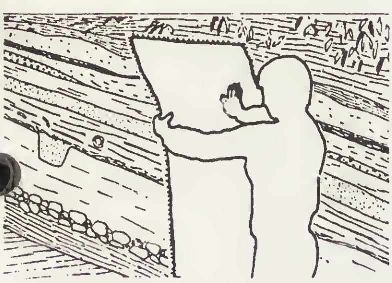
After the epoxy has completely set, the entire layer can be peeled away from the original earth surface. The freshly removed stratigraphic section is then cleaned with a brush and water to remove any non-adhering material.

V. Contrast Improvement:

In its dry state, the earth layers lose much of their color contrast. The color contrast can be permanently maintained by filling the pores vacated by water with a plastic resin which 'wets' the surface. A non-aqueous isocyanated, thinner than the type used in Step II, is used in this connection, and is painted on to the surface of the stratigraphic section.

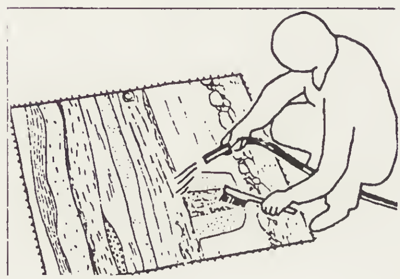
(1) Site preparation

(2) Backing epoxy

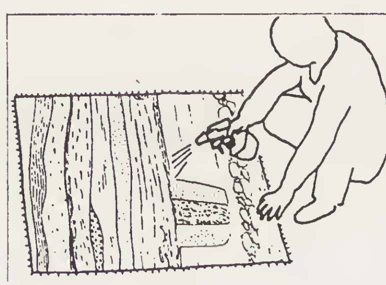


(3) Attaching starch-free cheese cloth

(4) Section removal



(5) Cleaning with a brush and water



(6) Contrast improvement

Figure 1. How to remove and preserve a stratigraphic section from an archaeological site.

VI. Attachment to a Rigid Support:

In this final step, the stratigraphic sections can be cut to any size or joined to make larger sections. It is recommended that the sections should be mounted on panels f display and storage. Araldite Epoxy GY1252 and Hardener HY8 mixed with glass microballoons for extra body, are used to affix the sections to rigid panels.

CONCLUSION

Ideally, it would be better to devise a method in whic the initially exposed soil surface can be used as the surfa actually displayed. In the above outlined procedures, this surface becomes the back which is covered by epoxy. In the future, the author intends to further modify these procedur to allow the initially exposed surface to also serve as the displayed surface.

The author has had good success with this combinati materials in applications involving a range of soil conditi The technique is fairly easy to apply, and gives very good, permanent results. The ability to use this system in conditions of high or low soil moisture content, and with dense, hard soil layers as well as for soft, sandy conditic makes this an appropriate technique for taking stratigraphi layers at a large variety of archaeological sites.

REFERENCES

1. Ehrhard Voigt and Gayle Gittins, 'The "Lackfilm" Method for Collecting Sedimentary Peels: Archaeological Applications', Journal of Field Archaeology/Vol.4, (1977), 449-457.

81/21/5

APPLICATION OF VACUUM DEVICE FOR ARCHAEOLOGICAL AMBER CONSERVATION

B. Kunkulienė, J. Lukšėnienė and J. Vaitkus

ICOM Committee for Conservation
6th Triennial Meeting

Ottawa 1981

Working Group: Siliceous Archaeological Materials

APPLICATION OF VACUUM DEVICE FOR ARCHAEOLOGICAL AMBER CONSERVATION

B. Kunkulienė, J. Lukšėnienė and J. Vaitkus

Art Museum of Lithuanian SSR
The Restoration Centre of Art Treasures named after
P. Gudynas
55 Gorky Street
Vilnius
Lithuanian SSR 232024
USSR

The destruction peculiarities of archaeological amber findings are described. An improved archaeological amber conservation method applying vacuum-device is proposed.

Numerous archaeological findings testify to the fact that in East Baltic countries adornments of amber were made in the Early Neolithic Age when the littoral sea had washed out sediment containing amber in Sambian peninsular. A significant quantity of adornments, amulets and other articles of amber have been found in the remnants of the Stone Age settlements in North-West Lithuania. Adornments of amber and their fragments have been detected in the settlements where archaeological monuments of the first centuries A.D. have been researched.

These valuable archaeological amber collections are preserved in the Palanga Amber Museum, a branch of the Art Museum of the Lithuanian SSR, opened in 1963. The exposition of this unique museum presents a comprehensive history of the formation of amber, the traditions of its processing and applying since the Stone Age to the present days.

The Baltic amber or succinite is excavated wood resin of the coniferous trees "Pinus succinifera ". Among the most characteristic chemical succinite features is the presence of succinic acid in it. This feature is widely applied in diagnosing the belonging of amber findings to the Baltic succinite. Succinite is a comparatively inert stuff but at the same time it is capable of oxidizing under the action of oxygen. In due course oxidizing penetrates into more and more deep layers in the result of which a distinctly expressed oxidized zone of reddish-brown hue appears on the surface of amber. The zone thickness depends on oxidation intensity and duration. The thickness of oxidized crust of amber findings hardly reaches 1 mm in some cases, in others it exceeds 2 mm and in certain cases the whole amber is oxidized. Apparently, this is explained by different oxygen access to the burried amber.

The received for restoration amber archaeological findings have fragile, darkened, covered with cracks, often expoliated weathered crust. As the process of oxidation under atmospheric conditions at the access of lights, especially ultra-violet rays, takes place more intensively, all the archaeological findings need urgent conservation.

The task of conservation is to stabilize amber, to reveal its hue and inner texture, to preserve the traces of processing on the surface of articles.

The conservation of archaeological amber by means of dammar resin solutions applying the method proposed by the German restorer Huber Paul in 1934 has some drawbacks. As the conservation processes under usual conditions are very long, amber swells in the solution in consequence of which the surface loses its scientifically valuable data on the processing of article surface. The assembly for consolidating archaeological amber constructed by us allows to speed up the conservation process much. The operating principle of the assembly consists in mechanically plunging the object under conservation into the consolidating resin solution at vacuum conditions. For that purpose a mobile little table is mounted into the assembly, a vessel with the solution is put on it and the amber under conservation is suspended over the vessel. The chamber is pressurized, vacuum is established and the object is plunged into the solution. It is established that the optimum vacuum value for amber impregnation is 20 mm Hg.

The optimum dammar resin solution concentration and impregnation time were determined observing the weight gain of the samples. The impregnation was repeated for several times until the weight gain ceased to increase. It was established that the rate and duration of impregnation depend on the thickness and porousness of the crust. Amber is consolidated most effectively with 4-6 % dammar resin solutions in turpentine, repeating the impregnation 4-10 times with the intervals for drying in the air. For opaque amber with a comparatively compact oxidized crust is recommended processing before impregnation over the vapour of ethyl alcohol and turpentine mixture (1 : 4) solutions under vacuum in the course of half an hour for increasing amber permeability.

Dammar resin consolidates amber well but its protective coating action against further oxidation process is not great.We have carried out e.g. an experimental storing with the aim of verifying the effectiveness of the protecting coating under museum conditions. We covered the conserved findings with the solutions of polybutylmethacrylate, amber varnish slag. After a five-year preservation it became clear that the samples covered with polybutylmethacrylate in acetone were in the best condition.

About 1000 units of archaeological amber have been conserved by the above described method in our conservation shops. They are pendants, buttons, rings, beads, things of cult and many other articles of amber of unique form decorated with geometrical ornament of various processing stages. Talismans and articles of cult are of the most various forms and processing. The schematic figures of people, animals, fish, vessels of amber reflected the primeval artistic style, the attitude of ancient people. Their preservation is one of the most responsible tasks of our restoration practice.

TRAINING OF RESTORERS

Coordinator : H.C. von Imhoff (Switzerland)

Assistant coordinator: A. Ballestrem (FRG)

Members : N.S.Baer (USA)
S. Bjarnhof (Denmark)
G. de Guichen (Italy)
H.W.M.Hodges (Canada)
J. Hodkinson (Canada)
H. Jedrzejewska (Poland)
L. Knoerle (FRG)
M. La Rose (Canada)
B. Ramsay (Canada)
R.M.Organ (USA)
C. Pearson (Australia)
I. Sandner (GDR)
M. Serck-Dewaide (Belgium)
R.L.Snowdon (UK)
S. Willisch (UK)

Programme 1978-1981

1. The problem of basic training versus specialisation (Sandner).
2. Didactic training material at the Dresden School(Sandner).
3. Survey of Institutions paying "Treasury grades" in Scotland (Snowdon).
4. Training and teaching material - Coordination for publication (Bjarnhof).
5. New Quarters for the New York University Conservation Center (Baer).
6. The fifth Questionnaire to Institutions, Museum administrations and conservators and restorers (Knoerle).
7. Development of basic conservation information (La Rose).
8. Training for mobile conservation units (La Rose).
9. Techniques of teaching (Pearson).
10. Training of teachers in conservation (Pearson).
11. Some ideas from the U.S. (Organ).
12. Training in Fine Art Conservation - The European way: Case history, the pros and cons (Willisch).
13. A graduate conservators comments on the effectiveness of university training in conservation - The North-American way (Ramsay).
14. Practical matters in the methodology of teaching on protection of cultural property (Jedrzejewska).
15. Technicalities of training (Hodges).

THE CONSERVATOR - RESTORER. A DEFINITION OF THE PROFESSION

Working Group Training of Restorers

with an introduction of H.C. von Imhoff, Coordinator

Le Bugnon 308
1782 Belfaux
Switzerland

INTRODUCTION

Noted to the history of origin, the purpose and the possible role of the document printed on the next pages.

The paper 'The Conservator - Restorer, a Definition of the Profession', is the result of three years of discussion about wordings, definitions and content between the members of this working-group, which now has renamed itself. It is the working-group TRAINING IN CONSERVATION AND RESTORATION of the ICOM - Conservation - Committee.

The initiating document was elaborated by the west-german conservators association 'Deutscher Restauratorenverband' under the chairwomanship of Agnes Ballestrem, at present assistant coordinator of this ICOM - CC - working-group. Later , in 1979, that document, in some other form, was adopted by the same association as their legal definition, entitled 'Das Berufsbild des Restaurators'.

French and english translations of this first document were incorrorated in the papers of the first meeting (ICCROM ST 1/3) of the Standards and Training Committee of the ICCROM General Assembly in 1978.

With some, more generalising modifications it was then adopted by the General Assembly 198o of the Swiss Association for Conservation and Restoration with a french and a german version as their legal definition. Other european national conservation organisations are in the process of adopting this document as well.

The ICOM - CC - working-group started to discuss the ICCROM text in 1978. A first round of interventions were made during 1979-8o and incorporated in the 'second proposal', again modified during the 'Symposium on Didactic Material', held as a joint meeting of ICCROM and this working-group in septembre 198o in Rome.

The version now presented for adoption to the membership of this working-group during the Ottawa ICOM Conservation Committee Triennial in 1981 will, subject to alterations and modifications, then be forwarded to the Committee's Directory Board for approval, our recommendation be to have it proposed for adoption to the Coucil of ICOM, who in turn could submit it to the next ICOM General Conference.

The advantage of such broad recognition is evident in view of the many and continuos differences and arguments about the content of f.e. conservation training programs, job - descriptions, responsibility-levels, classification-problems a.o. .

H. C. von Imhoff
Coordinator
April 1981

Unlike most professional activities, the profession of the conservator-restorer *) is not yet protected.Any - one who conserves and restores is called a conservator or restorer, rather than those, who have been trained properly.

Other professions have passed through this same phase during their evolution - like for example the profession of the physicist, of the lawyer and of the architect. From a concern for the profession, for the objects these people treat and to protect clients, attempts have been made at various times to

- a clearly define the profession,
- b delimit it in respect to related professions,
- c require proper training,
- d make it a protected profession.

The Conservator-Restorer's Activity

The conservator-restorer's activity consists of conservation, maintenance, restoration and technological examination of cultural heritage.

- By conservation and maintenance is meant any intervention on cultural heritage, which delays, prevents or hinders its material decay.
- By restoration is meant any intervention to regain a destroyed, disturbed and/or impaired readability and/or visual unity of the object for better comprehension of its meaning and message.
- Technological examination determines the material constituents of the object as well as the technology used in its production.

Conservator-restorers work in museums, in monument protection services, or on their own.As a complement to the interpreting activities of the art historian, the ethno-grapher and the archaeologist, it is the conservator-restorer's task to comprehend the material aspect of objects of historic or artistic significance in order to prevent their decay and to conserve them.

The impact and the ranking of the conservator - restorers activities.

The conservator-restorer has a particular responsa-bility in that he treats irreplaceable originals, which are often of great artistic, historic, cultural, socio-logical, scientific and commercial value. These objects are 'a significant expression of the spiritual, religious and artistic life of the past, often documents of a his-torical situation, wether they be works of the first rank or simple objects of evreyday life' **).

Indeed, the value of such objects lies not only in the quality of the execution, but also in the quality of their message as historical documents and consequently in their authenticity.

The historic object's documentary quality is the basis for research in art history, ethnography and other scientific disciplines. Since they all depend to a large degree on analysis and interpretation of'their'objects, their authenticity and appearance take on special signi-ficance.

But society also has a right to this quality of authenticity, at least as substantious : these objects are eloquent testimony of the most varied aspects of human evolution and social organisation. They carry information and establish value scales, which must be accessable to al This justifies the considerable expense of conserving cultural heritage, but equally underlines the importance of utilizing these means wisely in the public interest - that is, for the conservation of the object and its complete message and its qualities of authenticity.

Any conservation or restoration intervention runs the risk of harmful transformation or manipulation of the object. The conservator-restorer's task is to distinguish between the necessary and the superfluos, the possible and the impossible, the intervention that fosters the objects qualities and the one which is detrimental to it.

The conservator-restorer must be aware of the documentary nature and potential of an object. As each objects contains historic, stylistic, iconographic, spiritual, intellectual, technological and/or aesthetic messages, one must expect the conservator-restorer to be knowledgeable about all these aspects and be able to identify their traces and correlate them, as it is he who encounters them during his research and work on the object.

All interventions must be preceded by examinations undertaken in a scientific and methodic way, which attempt to understand the object in all its dimensions and, at the same time weigh the consequences of each manipulation. Who for lack of training is unable to carry out such examinations or who, for lack of interest or other reasons, neglects to proceed in this way, cannot be entrusted with the responsibility for treatment. Only a well trained and educated, experienced conservator-restorer is capable of correctly interpreting the results of such examinations, only he/she is aware of the consequences of the decisions to be made, and of the responsibilities.

If one considers that all scientific statements are developed using the following system - investigation of source, analysis of the object, interpretation and sythesis - then the need for the same methodological approach to interventions on an historic or artistic object becomes evident, only then the completed treatment becomes a new affirmation of an object and its significance, which may surpass the purely scientific message and considerably affect earlier findings.

Unlike the specialized historian of whatever disciplin, who describes and interprets the object, the conservator-restorer works on the object itself. His work is similiar to that of the surgeon - a manual activity above all. However, as in the surgeon's case, manual skill and practical sensitivity must be linked and are guided by theoretical knowledge and the capacity to, most often immediately, assess a situation, act upon it, well evaluating the consequences of the decission taken there and then.

An additional, essential element of a conservator-restorer is his sensitivity towards the perception of the object original state, condition and significance, which enables him to respect its actual state always during any intervention.

Today the conservator-restorer is asked to work as part of a team. Just as the surgeon cannot be simultaneously a radiologist, histologist and psychologist, the conservator-restorer is not at the same time art- or other -historian, chemist or another expert in natural or human sciences. But his work, like the surgeon's, should be complemented by the findings, the research and the analysis-results of these teampartners, whose collaboration he must be able to sollicit at the right time. This cooperation will function well if he/ he is able to formulate the questions scientifically,percise and to interpret the given answers correctly in their context.

The conservator-restorer's function is thus to solve conservation and restoration problems by methodic approach, appropriate use of methods of examination, critical evaluation of the results and correlated use of an up-to-date theoretical knowledge, practical experience and artistic sensitivity.

Delimitation against related professions.

The conservator-restorer will have to be careful to delimit his professional activities against those of artistic professions or the crafts. A basic criteria of this delimitation is that by his activities the conservator-restorer does not create new cultural objects. It is the craft and the artistic professions, such as smith-forgers, guilders, cabinetmakers, decorator and others, to physically reconstruct, what no longer exists or what cannot be preserved, hopefully under guidance and aware of the findings the conservator-restorer's examinations of the remains have providied.

It is also their function and competence to reconstruct lost or destroyed cultural heritage if need be, on the basis of historical, archaeological and other research, scientific investigations and analysis and thus pass on important information and traditions.

The recommendation as to wether the intervention on an object of historic ond/or artistic significance should be undertaken by an artist, a craftsman or a conservator-restorer can only be made by an experienced, educated and well trained conservator-restorer, as it is he who has the full complement of means to examine the object, determine its condition and find its material documentary significance.

Training and education of the conservator-restorer

To conform with the professional characteristics and specifications described above, future conservator-restorers must receive training based on technical and scientific principles and general education in human sciences. Where such training should be given, what type of institution lends itself best to it, will not be examined here.

Basic training consists of technical training, which involves the developement of manual skills as well as the transmission of theoretical knowledge about materials, techniques and objects encountered in practice.

Training in scientific methodology is to foster the capacity to solve conservation problems following a systematic approach, using percise research and interpreting the results critically.

In this context theoretical training and education includes the following subjects:

- knowledge of technology and materials
- chemistry, biology and physics for conservation
- histroy of art and civilisations
- conservation and restoration technology and their history
- conservationtheory and ethics
- methods of research and documentation

The emphasis in training conservator-restorers should always be placed on practice, both in working on the object and in confronting the conservation-student with it. The interpretative and artistic sensitivity must be educated further during the entire formation.

The conservator-restorer's self-critical attitude towards his own knowledge, his own activity and his decisionmaking must be stimulated early on as a basis for the necessary critical attitude towards any problem or solution of conservation and restoration.

During advaces training, the subjects and the professional knowledge must be improved, heightened and enlarged, while the training in administration and management has to be added.

Written work showing the combination of theoretical knowledge and critical attitude will be expected. As during the basic training emphasis must be also placed in this period on the continuos confrontation with objects, their conservation and restoration problems.

The progress of advanced training over basic training consists particularly in acquiring more systematic and more thourough examinationcapacity of all aspects of the conservation of an object and this object itself, a better familiarity with planing and justifying of interventions, and the developement of independent working habits.

The solution of more difficult conservation and restorationproblems will have to be defended, even including the particular case of a decision not to undertake any intervention.

A thesis or diploma - paper should terminate the training. Internships are essential parts of training at any level.

*) In this paper the professional concerned is called 'conservator-restorer. This is a compromise, as the same professional is called 'conservator'in the anglo-saxon aerea, while he/she is called 'restorer' in Romance and german languages.

**) G.S.Graf Adelmann, 'Restaurator und Denkmalpflege' in'Nachrichtenblatt der Denkmalpflege in Baden - Württemberg', Vol.8, N° 3, pp 61 f. .

WORKING GROUP TRAINING OF RESTORERS

Some remarks about recent developments in formal training in conservation and restoration - educational systems and their consequences in different countries

Coordinator: H.C. von Imhoff
Le Bugnon 308
1782 Belfaux
Switzerland

More than double the number of papers have been sent in by members of the working group on training, now renamed 'Training in Conservation and Restoration', to be accepted for the preprints of the ICOM - CC - Triennial 1981 in Ottawa, compared to Venice 1975 and Zagreb 1978. This is not a proove but certainly an indication for a more pronounced concern and profound interest in problems related to education and training in this profession. Similar indication can be derivated looking at the growing number of participants in the sessions of the group, some lo in Venice, well over a hundered in Zagreb, three years later.

The politic prominence and significance conservation of cultural heritage has gained worldwide during the last decade (World Heritage List, UNESCO - Recommendation on movable cultural property, ICOMOS - activities, ICCROM, ICOM - projects Cairo and Kuweit a.o.) and the subsequent economic and administrative implications of this change in importance have helped to develope the awareness,that there is greater need than ever to regularise in whatever way

- the training of conservator - restorers,
- the ascertation of their continuos professional developement,
- their status, scope and role within the administration, be it an international, a national or else one,
- their responsibility and role in the administration of cultural heritage,

and by doing so, discuss the philiosophy and ethics of conservation in general.

A first step to provide for a sound basis for discussion can be to define the profession in clear terms understandable for all concerned and interested. Starting out from a workingpaper of the westgerman restorers association DRV edited under the chairwomanship of our assistant coordinator Agnes Ballestrem, and discussing wordings and meanings since 1978 within the working group, such a definition is now presented under the title ' THE CONSERVATOR = RESTORER, A DEFINITION OF THE PROFESSION ', paper 81/22/o of these preprints; indications to its possible role and regarding future steps are given in its introduction.

Parallel to the definition of our trade it is necessary to discuss to what extend one person can englobe all what even specialised conservation entails without her becoming a Jack of all trades, but master of none (81/22/1) and to discuss how this increasing responsibility can and should be shared with our partners, the conservation - scientists, curators, historians, administrators, wardens and others (81/22/2).

One fundamental to help solve some of the problems is certainly a thoroughly planned training in conservation and restoration. The ways to institute it, will be and are national ones, at least for the industrialised nations of the northern hemisphere - the ways of training have to fit their respective traditions, their cultural values, their administrative patterns and specific ways adopted for problemsolving and can only develope on a government structure and economy strong enough to support such activities.

For the countries, which in the North - South - Dialog are part of the southern interlocutors crew, training in conservation is something which normally happens abroad and which often is not specifically adapted to the needs of the individual country. Already the selection of candidates for training is a problem, the solution to which is more often a political one than one based on educational criteria and proper motivation. ICCROM and its regional centres and a few other initiative countries have embarked on ways to find some kind of solution to these problems. Compared to the size of the task, the amount of material to await conservationtreatment and the difficulties to overcome forming supportive, financially sound and intelligent structures within the different countries, these beginnings are only droplets in the bucket.

There are several reviews of the ways single institutions, whole countries train, there are comparison papers, within these and previous ICOM - preprints, there is ICCROM's Training Index and R.Straub's only typewritten manuscript, which compares and lists european and northamerican programs, with comments, annotations, listings to subjects of interest. These show that the anglo-saxon countries seem to have found ways to train and educate and position their conservators within society to fit the requirements of conservation, their own need and satisfaction. Those programs may need to be refined and further developed, but seem generally to be appropriate.

The same seems true for eastern european countries,in different degrees of accompletion so, if one compares f.e. Yugoslavia to Poland. While all these nations have recognised that conservation is to be taught at university level or in connection with university-like institutions, the mediterranean latin countries have established defined carreers, the latest being Portugal to put it into law in 198o, all based on some kind of National Institute of Conservation and Restoration,with annexed training responsibilities, the conservator - restorer viewed as a specialised technician. Besides the highest level obtainable in Spain in this field, there are no connections or recognitions by universities.

With no possibility to incorporate training in conservation into their universities, Westgermany and Switzerland are in a difficult situation as well. While,besides Austria and Denmark,Germany has as institution , similar to university for the fine arts field,the so called academy of art, which can incorporate conservationtraining, Switzerland lacks these possibilities or has too narrow legal definitions of similar institutions,as to offer possible alternative ways. An attempt to use the arts and trade college institution there to build a trainingprogram , failed . Whilst the administration pretended human problems as the reason, as 8 of 1o students quitt furiously and the only conservators contract was not renewed, the actual reason is a complete misconception by the school authorities and by the service of monu..ents people at different levels, of what conservation is **contrary** to the Swiss Association for Conservation and Restoration, who has adopted a slightly different version of the 'definition' 81/22/o -i.e. in essence the old dispute 'renovation' versus conservation, renovation momentanously winning in the current of a nostalgic 'heimatstil' and a mystifiing conception of craftsmanship.

One of the keyquestions in the developement of these different national ways to conservation training is the elasticity of the universitystructure specifically and and of the educational system generally - countries with strong emphasis on pure academic and scientific scholarliness,have immense difficulties to incorporate conservation training into their universities, like Germany, France, Switzerland and others. France nevertheless succeeded.

Countries,whose system allows for a bachelor in studioart or a baccalaureat in ceramica are at ease to accept conservationstudents within their ranks and will rank them as equal later. Contrary to this,systems and nations, where any type of manual work is automatically classified as blue collar activity and at the respective level, that

means, financially and socially lower than white collar work, are in trouble to classify their conservators at a level equal to the collegues in the team which performs the administration of our cultural heritage, backed by the authority which derivates from the appropriate social position, which is given to the curator, the archaeologist, the historian, the scientist, the top administrator, all of them trained at university. Experience tells us that who is paid higher, is ranked higher, is given more responsibility, is having more authority. What this means in conservation is well known to all of us !
It is not merely a question of legal and administrative structures, but one of hum an impact and human relations als What happened in Switzerland is a crafty illustration of the importance of these considerations and of the importanc of the paragraph in the 'DEFINITION', which deals with 'the delimitation to other prefessions'.

One thing to help training in conservation develope in the right direction, is the availability of appropriate didactic material. Up to now every conservator, who is involved in teaching conservation, has to make up all his teaching aids himself. Some bibliographies exist; some readinglists, some films to document specific technologies, a few slideshows to guide the practioneer, one or the other book incidentally suitable for teaching, but no series of textbooks for teaching, no leaflets available to everybody, nor medells for sale, etc. - with the exception of some of ICCROMs recent publications and some Smithsonian material.

Butterworth has started its series'conservation in art and archaeology', to report the state of the arts of the different specific disciplines . They'll be of help for teachers in conservation, once they are on the market. In the direction of proper conservation teaching and textbooks the english Crafts Council is pionneering with its project CONSERVATION SCIENCE TEACHING PUBLICATIONS (81/22/(remarkable not only for its aim, but also for the open concept and manner of approach, directed solely by the subject matter.

This lack of didactic material became painfully obvious during the'symposium on didactic material for teaching in conservation' in the first week of september 198o in Rome, organised jointly by ICCROM and this working group. The nearly 5o participants were all mainly teachers in conservation and brought everything they knew was interesting and serving their teaching - it was not much yet. So two recommendations were voted on and guidelines for production in the main categories of didactic material produced, but not published yet. The recommendations read:

no. 1
The participants of the symposium on didactic material in conservation in september 1981 in Rome ask ICCROM to collect in a systematic way continuously information about existing didactic material in conservation and about didactic material relevant to teach conservation.

The listing of this material and material under production should be made available to those interested with some kind of publication.

To the extend possible ICCROM should collect this material. By means of a committee it could be evaluated and decisions made as to wether this material should or could be translated and/or edited.

Any type of didactic material shall be considered: books, films, video, slides, technical cards, model a.o.

No. 2

ICCROM is asked by the participants to set up a committee of conservators, conservation scientists and experts in education to prepare a regular ICCROM course, or if needed, different types of courses, to train and educate teachers in conservation and conservation science in educational techniques.

Evaluation of training programs by their own, in the meantime experienced former students and by experts from outside will help to ameliorate the courses. Ample information and intensive collaboration of all concerned will help to foster developement of training in conservation and restoration in every aspect, in every direction and by all, who are responsible and entrusted with the preservation of cultural heritage.

H. C. von Imhoff
May 1981

81/22/1

CONSERVATORS OR CHARPERSONS?

H.W.M.Hodges

ICOM Committee for Conservation
6th Triennial Meeting

Ottawa 1981

Working Group: Training of Restorers

CONSERVATORS OR CHARPERSONS?

H.W.M.Hodges

Art Conservation Program
Queen's University
Kingston K7L 3N6, Ontario
Canada

The conservator today is expected increasingly to perform a dual role as a specialist restorer and as a generalist to monitor museum functions and environment. It is argued that this tendency is already leading to an inefficient use of man-power, and it is suggested that training programmes should now be considering training specialists in museum environmental control, leaving other specialists free to work unhampered in the traditional studio-orientated manner.

There is a persistent myth that the conservator is a quiet operator, more nearly approaching the classical concept of the alchemist than one might think possible. Inured from the world in his studio, he is seen as a man of great skill and endless patience, who has learnt, partly by example and partly by his own diligent reading and research, how cunningly to manipulate scalpel, brush and materials, and how best to bend the gifts of science to his particular needs. In this, as in all myths, there is a grain of truth. Such people really do exist, or should I say, rather they endeavour to approach this definition.

This is not the place to explore how the myth grew or why it is perpetuated, other than to suggest that we, the educators, may be to some extent to blame for its survival. The sad truth is that in the field of conservation today there is place for fewer and fewer such alchemists. In the real world the conservator is not only required to perform acts of transmutation, but also to deal with the major enemies of museum collections - dirt and ignorance.

There was a time when one might have believed that this would not always be so; briefly it seemed as though courses in museology and museum studies might produce a body of professional curators adequately trained to cope with their main duties - preservation, study and display. Now we know that this is not to be so; museum administration and interpretation have pre-empted all but a minor part of such training, and curators arrive on the market less able to look after the health of a collection than a well-versed Victorian housekeeper. Let those who can do: more and more the care of collections has been sequestered to the conservator.

In the 1940's, when the words conservator and conservation were first coined to describe our then nascent profession, these broader areas of concern were seldom considered. We were, most of us, reared in studios and laboratories, and it was in those confines that we were supposed to work. At that time we were meant to be the mythical alchemists, and woe betide us if we dared to overstep our threshold. It was unthinkable that we should be asked to advise the curator about such matters as storage or display. It need hardly be said that the outcome of this policy was an appalling deterioration in the condition of the more delicate items in the collections. Eventually it was to dawn upon all but the most stubborn of curators that they needed help, and it fell upon the conservators to spend increasing amounts of their time attending to what are (or should be) curatorial duties - control of environment, proper storage and display techniques, and the general maintenance and cleaning of the collections. As a corollary less time could be spared by the conservator to undertake the work for which he had primarily been trained - repair and restoration.

The situation has been made the more acute with the growing popularity of the travelling exhibition. Whether one elects to sympathise with the concept of bringing culture to the people or to condemn it as a mere political gambit, it has become a fact with which we have to live; and this despite that fact that some objects stand little more chance of survival in transit than an octogenarian would have on a training course for commandos. It is the curatorial body that has decided upon the policy; it is the conservator who has been asked to implement it.

Had my title not already suggested it, by now it must be obvious that I have a complaint to make. It is not, however, that I feel that conservation has become too broadened or over-extended. Far from it, it is axiomatic that if it is essential to the well-being of our collections that the conservator must undertake these wider responsibilities, then so be it. The situation, nevertheless, presents those concerned with the education of conservators with a very real problem, namely: is it reasonable to expect future conservators to be both guardians of the collections and specialist restorers at the same time?

Until quite recently one could have argued with considerable justification that this was so, and that the restorer could also advise on the generalities of conservation. Indeed it holds good that any conservator, no matter how narrow his area of specialization is intended, should receive a sound broad background training in conservation principles. We are, nevertheless, collecting in our museums an ever wider range of materials, much of quite recent origin, and a considerable proportion of which was never created with longlevity in mind. The preservation aspect of our work has hence become increasingly complex as, too, has the restoration aspect due to the increasing number of materials and techniques available for our use. In short, any conservator who has a thorough grasp of air-conditioning, lighting, the construction and maintenance of museum storage, the packing and transportation of objects, the care of objects on display, and the ability to maintain a varied collection in clean and hygenic conditions, not to mention keeping an old building in serviceable condition, is already a specialist, and has no need to retire to a studio from time to time to perform miracles of restoration to prove his capabilities or usefulness.

The crux of my argument, then, is this: have we now arrived at a time when training programmes should be considering museum environmental control, in the sense just described, as an area of specialization? Or should we continue to insist upon one of the more traditional aspects of specialization - fine art, paper, furniture, textiles, archaeology, ethnography - and trust that the broad background that they are given during this training will be sufficient for our students to get by?

As things stand, many conservators are required to act as trouble-shooters for the museum and are equally expected to work on problems of restoration that demand considerable concentration. To be dealing at one moment with a difficult operation in the studio, and to have to relinquish it to cope with some quite different question of conservation, often at short notice, is a far from ideal method of working. Furthermore, without giving offence to my colleagues who are specialists in various fields of restoration, one wonders which of us are sufficiently versed in museum environmental control to be able to give immediate and spontaneous advice on all its aspects. My feeling is that far too often we are obliged to do a considerable amount of "homework" before we can provide an answer with any confidence. If this trend towards a dual role for the conservator continues to extend, and there is no sign that it will do otherwise, we can only become increasingly less efficient.

The field of conservation has often been compared with that of medicine, an analogy that one should follow more closely. Within the medical profession, specialization is, of course, accepted as normal, although it was not always thus. Equally the profession has to rely upon its general practitioners, its family doctors, and those whose concern is public health and preventive medicine. It is unthinkable that the profession could operate without the support of the latter, and yet is this not precisely what our own profession is attempting to do?

I recognize that this proposal will not meet with universal approval. Unlike the medical profession, where the division between surgeon and doctor came early in its history, we became an entity as a result of the merger of many specialists, and the concept of a conservator who is not studio or laboratory based must be alien to our way of seeing things. However, it is not being suggested that we should train conservators who are ignorant of studio practices and restoration techniques. What is being proposed, rather, is that museum environmental control should be allowed as a specialization within a training programme alongside other areas of specialization, and that during the period of training students should become familiar with studio work, just as at the present students specializing in studio work became familiar with the general concepts of museum environmental control.

It could be argued that the subject of museum environmental control is too amorphous and that there is a danger of training Jacks of all trades and masters of none. In fact the field is very far from being amorphous, and there exists an enormous literature that needs to be mastered before one can adequately advise on environmental control. Admittedly the information is at present very widely scattered and, apart from a few areas, very little attempt has been made to correlate it to such an extent that for some aspects one must still refer to The Deterioration of Materials by G.A. Greathouse and C.J. Wessel as a source book, a work that was published in 1954 with a very different readership in mind. It is also worth observing in this context the large number of fairly superficial technical bulletins and pamphlets that have been produced in recent years by various organizations, all of which are intended to help the curator or layman resolve the problems of museum design and maintenance, and the care of collections. Despite these well-intentioned efforts many museums remain charnel-houses for antiquities and works of art. It is not that the subject matter is amorphous but that, because it is not usually our primary concern, we have allowed it to appear so, while deluding ourselves into believing that a technical pamphlet can be read and acted upon by the layman. Obviously these technical bulletins have their uses, but they can no more replace the man on the spot than a book on self-medication can replace the family physician. Too often, one finds, an attempt to relieve the symptons rather than cure the disease.

As to the Jack of all trades, this is exactly what is not being proposed. It is not being suggested that students be given a perfunctory knowledge of the care of collections, then to be turned loose on the museum world. It is a dangerous proverb that says that in the land of the blind the one-eyed are kings: in the realm of conservation the one-eyed may be a greater menace than the blind. Only in rare cases of disaster, such as flood and fire, does our profession need the help of paramedics. What is envisaged, rather, is a conservator with a thorough understanding of the anatomy, physiology and pathology of the museum and its contents, an ability to diagnose or foresee malfunctions before any damage is done, and sufficiently versed to know when he must turn to other specialist colleagues for help.

Finally, one has to ask what is probably the most crucial question of all. Were one to train specialist conservators of the type just described, would they be given employment? My opinion is that, at this juncture, they would not, if only for the very good reason that the dual role has become expected of conservators, and it is obviously difficult to persuade employers to enlist two people to deal with work that they believe can be done by one. The dilemma in which one finds oneself is, thus, should one now begin to train students in this way and proselytize for their acceptance; or should we delay until the situation has become so chronic that training in this field is forced upon us?

81/22/2

CONSERVATION DES COLLECTIONS: CO-RESPONSABILITE DU CONSERVATEUR ET DU RESTAURATEUR - SES CONSEQUENCES

J. Thiebaut

Comité pour la conservation de l'ICOM
6ème Réunion triennale
Ottawa 1981

Groupe de travail: Formation des restaurateurs

CONSERVATION DES COLLECTIONS: CO-RESPONSABILITE DU CONSERVATEUR ET DU RESTAURATEUR - SES CONSEQUENCES

J. Thiebaut

Conservateur Direction des Musées de France
Palais du Louvre
75041 Paris
France

RESUME

Quelques exemples rappellent les conflits qui peuvent se manifester entre le conservateur spécialiste de l'étude des collections et le restaurateur spécialiste de l'état des collections.

La solution de ces conflits réside dans la reconnaissance mutuelle des missions des partenaires, et la mise en commun de leurs activités au bénéfice des témoins culturels sans négliger les techniques de documentation, l'arbitrage et l'amélioration des formations de ces deux catégories de spécialistes qui doivent être, en partie, communes.

C'est une vieille querelle que celle de savoir qui du conservateur ou du restaurateur (termes utilisés généralement en français) est responsable de l'état des collections, si l'on entend par état, à la fois :

1- les bonnes conditions de stockage et de présentation,

2- les précautions utiles lors des mouvements, transferts, exposition,

3- les interventions judicieuses pour la remise en état en cas de dommages.

Il semble parfois que le conservateur d'un département ou d'un musée, homme de science et d'érudition, doive plutôt se consacrer à l'étude de l'histoire des collections et à l'exploitation rigoureuse de sa documentation pour éclairer des points d'histoire, de civilisation, de courants esthétiques, d'évolution des techniques; qu'il doive aussi donner son temps à la présentation et à l'"animation" des collections (ce dernier point est parfois contesté) afin d'en faciliter l'approche et la compréhension aux diverses catégories de visiteurs; qu'il soit, enfin, un agent actif de protection du patrimoine culturel local ou de sa spécialité en se tenant informé et en intervenant chaque fois que celui-ci risque d'être dégradé ou détruit.

Dans cette conception, il reviendrait au restaurateur de contrôler régulièrement l'état matériel des objets en présentation ou en réserve, avant ou aprés exposition et "à fortiori", d'intervenir en cas de dommages.

Ainsi, le conservateur n'aurait à se préoccuper que des valeurs portées par l'objet et le restaurateur que du support de ces valeurs.

Mais peut-on, dans la réalité, tracer une frontière aussi nette entre des activités qui, pour être menées par des agents différents, n'en convergent pas moins vers le même but : la sauvegarde de témoins ?

Le respect de l'objet et les réponses qu'il est susceptible d'apporter à d'autres interrogations ne seront-ils pas renforcés et enrichis si chaque partenaire est soucieux d'un travail en commun, nourri des connaissances et des motifs de l'autre ?

Le terme anglais de "curator" souligne -peut-être mieux que les vocables français de conservateur et restaurateur qu'il traduit parfois- qu'il convient, comme dans la définition juridique française du "curateur", de prodiguer au <u>témoin</u> à la fois la <u>science</u> et les <u>soins</u>.

Examinons quelques exemples de pôles d'intérêt respectifs des partenaires, des dangers auxquels ils peuvent exposer les témoins et des remèdes possibles.

Anxieux de percer les énigmes du passé, le conservateur pourrait avoir une attitude destructrice à l'égard de l'objet, en cherchant à procéder à des analyses trop poussées du support.

Dans cette recherche, il s'opposerait à des conservateurs et à des restaurateurs qui soutiendraient l'obligation du maintien de l'objet en son état et intégrité.

Les méthodes d'analyse actuelles permettent, en partie, d'éviter ce dilemne, mais il est indispensable que des opérations d'investigation susceptibles de laisser des traces sur l'objet et pouvant, dans l'avenir, donner lieu à des interprétations sujettes à caution, soient précisément localisées et <u>documentées</u> et qu'elles soient exactement transcrites au dossier de l'objet.

De même, les méthodes de restauration actuelles sont assez affinées pour assurer, en principe, le sauvetage ou la réparation du témoin sans faire disparaître des éléments constitutifs de matériaux ou de techniques ce qui compromettrait des analyses ultèrieures.

Il est aussi indispensable, dans la phase de restauration ou d'entretien, que le dossier du témoin soit parfaitement <u>documenté</u> par l'indication des constats et interventions successifs ainsi que des méthodes et produits employés.

Des photographies d'état en dimension normale ou des macro-photographies seront toujours souhaitables.

En conservation comme en restauration, il s'agit de transmettre le témoin dans le meilleur état possible (pour lui assurer une durée de vie plus longue) et un témoin qui ne soit pas trop défiguré par des interventions (pour permettre des investigations ultèrieures plus affinées ou dans d'autres directions).

Examinons un autre cas de conflit possible.

Dans le cas d'un objet trés caractéristique ou exemplaire sur le plan esthétique, historique ou technique, le conservateur peut être tenté de la présenter durant de longues périodes ou de le proposer trop souvent aux demandes d'expositions temporaires.

A l'opposé, le restaurateur qui constate que le témoin souffre de mises en présentation ou d'expositions trop fréquentes répugnera à satisfaire de nouvelles demandes.

Il importe que les constats d'état réguliers effectués par le restaurateur soient pris en compte par le conservateur dans l'examen des demandes de présentation et d'exposition, même, et surtout, si ils doivent l'amener à les ajourner fût-ce au détriment de la "publicité" (dangereuse parfois), qu'elles apportent au musée.

C'est l'occasion de rappeler qu'il faut sans doute revoir la politique mondiale d'expositions et ne pas céder à la tendance multiplicative de ces grands et fréquents changements de l'environnement des témoins. Les communications de masse et les plus grandes facilités de voyage rendent moins nécessaires ces transplantations de témoins qui n'ont souvent résisté aux siècles que par l'immobilité, l'obscurité et l'isolement.

L'analyse et les interventions trop poussées et les changements d'environnement sont les dangers majeurs qui menacent le témoin.

Pour des témoins constitués de certains matériaux, des conditions physiques pourront se révéler trés agressives. Pour les tapisseries, dessins, objets en plume, ce sera une trop forte luminosité, pour d'autre, une humidité ou une sécheresse excessive.

Un conservateur recherchant une présentation brillante et sophistiquée afin qu'elle soit plus attractive-pense-t-il - pour le public, pourra s'opposer au restaurateur plus inquiet de la santé du témoin que de l'émerveillement supposé du public.

Les solutions des conflits sont toujours dans l'information réciproque et la documentation rigoureuse et, si besoin est, dans l'arbitrage rendu par le responsable général du service ou de l'établissement.

Les réserves peuvent aussi constituer un champ de bataille exemplaire :

Parce que certains témoins ne seront pas " à la mode"; ou dans le champ de recherche de l'érudit, ou la présentation dans les salles trop chargées, ou le témoin trés abimé, on peut assister à un encombrement des réserves ou à des réserves trés mal rangées ou mal équipées compromettant la recherche ou la durée des objets sans parler des réserves non ou mal surveillées; le pire étant la "réserve-pourrissoir" où des témoins trés endommagés et porteurs de germes contamineront des témoins sains non isolés de ces grands malades.

L'organisation et le contrôle régulier des réserves doivent être le fruit d'une collaboration qui devrait être plus neutre que dans les exemples précédents entre le conservateur et le restaurateur. Il y sera moins question de prestige et peut-être pourront-ils communier dans le respect de l'objet à moins que le conservateur, limité dans ses projets d'exposition, de salles d'accueil ou de documentation par l'exiguité de ses locaux, soit porté à sacrifier les locaux de laboratoire, d'"infirmerie" et des réserves.

Peut-être faudra-t-il envisager d'une manière générale une inspection périodique des réserves par des agents extérieurs aux établissements visités et relevant, soit de l'autorité de tutelle des établissements, soit d'une commission nationale de protection du patrimoine.

Dernier exemple : les fouilles (où peut intervenir un troisième partenaire).

Si le responsable de la fouille est conservateur autant qu'archéologue, il sera aussi soucieux d'une méthode rigoureuse de fouille que des mesures nécessaires au stockage convenable et aux premières opérations de nettoyage et de mise en état des témoins recueillis et il aura tendance à recueillir et déposer le maximum de témoins.

S'il s'agit d'un archéologue "impénitent" peut-être serait-il davantage préoccupé par la conduite de la fouille et la tenue du journal qu'animé du désir de consolider et réserver pour des études ultérieures la totalité des témoins.

Pour le restaurateur, la difficulté résidera dans le nombre important d'opérations à effectuer dans des conditions parfois précaires. Le temps, l'assistance de personnel suffisant, les matériaux ou outillages lui manqueront souvent, surtout si les couches sont trés bouleversées, les objets trés dispersés et émiéttés.

Dans ce cas particulier les facteurs extérieurs: contrainte de temps, de conditions climatiques, de moyens en personnel ou en matériel peuvent amener le responsable général à se prononcer sur les sacrifices nécessaires. La fouille proprement dite devrait être prioritaire, car le gisement constitue un ensemble significatif et parfois susceptible de disparaître rapidement qui doit être soigneusement quantifié et enregistré. A la limite, il faut donc procéder par sondage aléatoire à l'élimination des pièces ou des fragments qui ne pourront être reconstitués ou transférés dans des dépôts. La nécessité soulignée dans chaque cas d'une documentation trés poussée est donc ici impérieuse.

Les missions spécifiques et la responsabilité que ressentent les conservateurs et les restaurateurs, chacun pour leur part, trouveront sans doute moyen de s'exprimer et les divergences éventuelles de s'atténuer si les uns et les autres participent, et si possible en commun, aux tâches de formation et de perfectionnement des métiers et professions intéressant le patrimoine culturel.

En éveillant ceux qui se destinent à ces métiers ou en améliorant les connaissances de ceux qui en ont déjà la pratique, les uns et les autres devraient apprendre à s'apprécier mutuellement et à reconnaître leurs compétences spécifiques dans la sauvegarde des témoins.

Cette reconnaissance mutuelle, bien mieux, pourrait naître et se développer plus tôt si, dans chaque pays conscient de la valeur de son patrimoine culturel, existent ou sont instituées, à côté ou à la place des écoles ou Instituts de restauration encore peu nombreux, des Ecoles Nationales des Métiers du Patrimoine ou du Patrimoine qui rassembleraient, dans un tronc commun et des sections spécialisées, les divers personnels aux trois niveaux du recrutement et de la formation initiale; du perfectionnement, de la recherche et de l'expérimentation des méthodes, techniques et matériaux.

Le Conseil Consultatif ou le Conseil Supérieur de ces écoles devraient évidemment rassembler les représentants des divers secteurs patrimoniaux: fouilles, monuments, sites classés, musées, archives, parcs naturels, éco-musées, création contemporaine etc... et veiller à y rassembler et éprouver les techniques auxiliaires nécessaires à l'amélioration de ces secteurs: la méthodologie, l'analyse, la documentation, l'informatique où l'effort de normalisation doit être poursuivi (sans exclure les révisions progressives).

En conclusion, les discussions légitimes, souvent fécondes d'ailleurs, qui peuvent naître entre "conservateurs" et "restaurateurs" doivent être résolues par :

1- le partage de responsabilité(l'aspect juridique de cette question peut faire l'objet d'une réflexion commune).

2- le travail en collaboration

3- la documentation bien tenue (dans ce domaine, il faudrait aboutir à un codage international des techniques et opérations d'analyse d'une part, à un codage international des techniques et opérations de restauration d'autre part, codages d'autant plus nécessaires que des opérations de restauration doivent logiquement être précédées par des opérations d'analyse orientatrices des interventions).

4- l'arbitrage au bénéfice du "témoin", en cas de conflit de compétences, d'une part, en cas d'expérimentation, d'innovation en matière d'analyse ou d'intervention, d'autre part.

Cet arbitrage peut être rendu à trois niveaux :

- le chef d'établissement
- l'autorité de tutelle du secteur patrimonial
- la commission nationale de protection du patrimoine (ou le conseil supérieur de l'Ecole Nationale du Patrimoine).

5- la collaboration à la formation des professionnels du Patrimoine

6- chaque fois que ce sera possible, une formation commune générale au sein d'une institution nationale de formation.

<u>ANNEXE</u> : Schéma de tableau des responsabilités communes et spécifiques du conservateur ou du restaurateur.

Ce tableau peut servir de liste de contrôle d'opération pour la conservation des collections.

+

CONSERVATION DES COLLECTIONS
SCHEMA DE
TABLEAU DES RESPONDABILITES
COMMUNES ET SPECIFIQUES
DU CONSERVATEUR ET DU RESTAURATEUR
(LISTE DE CONTROLE D'OPERATION)

ACTIONS — RESPONSABILITE DU CONSERVATEUR				RESPONSABILITE DU RESTAURATEUR
A-<u>INVENTAIRE</u>				
Etablissement et tenue à jour	X		X	Fiche d'état de l'objet et tenue à jour
1- immatriculation	X		X	
2- description,photographie	X		X	
3- état de l'objet (avec le restaurateur)		☐		3- à l'entrée (avec le conservateur)
4- mode d'entrée	X		-	
5- <u>historique</u>: auteur,commande,ventes,dépôts,expositions	X	☐	X	5- indication des interventions connues antérieures à l'entrée.
B-<u>LOCALISATION</u>				
1- affectation initiale (local examiné avec le restaurateur)	X	☐	X	1- contrôle des conditions du local(indication des remèdes apportés)
2- inscription des mouvements successifs:changement de local,passage au laboratoire:analyse,intervention,passage en réserve,dépôt,expositions temporaires.	X	☐	X	2- contrôle d'état de l'objet et des locaux pour chaque mouvement avec dossier et photographie pour les analyses et les interventions(techniques et produits utilisés)

.../...

ACTIONS — RESPONSABILITE DU CONSERVATEUR				RESPONSABILITE DU RESTAURATEUR
C- ETAT ET SECURITE DES COLLECTIONS				
1-programme d'inspection des collections (établi en fonction de l'état avec le restaurateur)	X	☐	X	1- programme d'inspection (avec le conservateur)
-	-		X	2- contrôle des inspections
3-consignes d'entretien (avec le restaurateur)	X	☐	X	3- indication des nettoyages (produits et techniques)
				4- contrôle d'entretien
5-mentions succinctes des dégradations et des interventions.	X	☐	X	5- indications détaillées des interventions:dossier et photographie(produits et techniques)
D-PARTICIPATION A LA FORMATION ET A LA RECHERCHE				
1- programmes de formation et de perfectionnement: utilisation des exemples réflexions	X	☐	X	1- programme de formation et de perfectionnement: utilisation des cas et réflexions
2- programme d'analyse des collections(avec l'avis du restaurateur)	X	☐	X	2- avis sur les programmes d'analyse
3- avis sur les programmes d'intervention	X	☐	X	3- programme d'intervention (avec avis du conservateur)

NB.: La tenue soigneuse du dossier des témoins représente une quantité importante d'informations. Il semble souhaitable d'utiliser les <u>codages normalisés</u> et l'enregistrement <u>automatique</u> des données, plutôt que les enregistrements manuels moins réguliers et plus longs.

81/22/3

A PREPARATORY CONSERVATION COURSE FOR FIRST-DEGREE STUDENTS OF ART HISTORY

Rosamond D. Harley

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

A PREPARATORY CONSERVATION COURSE FOR FIRST-DEGREE STUDENTS OF ART HISTORY

Rosamond D. Harley

Department of Conservation
Gateshead Technical College
Durham Road
Gateshead
Tyne & Wear NE9 5BN
Great Britain

ABSTRACT

Art historians exist at different levels, from museum curator to undergraduate student; their motivation and ability differs and the approach in any technical course should vary accordingly. The ethical basis of a technical course related to conservation for art-history students at first-degree level is considered and the content of the course offered at Gateshead for Newcastle Polytechnic art-history students is briefly described.

At the ICOM conference in 1978 Hanna Jedrzejewska made an excellent case for the inclusion of technical matters in the training of art historians. Her own experience in supervising such a course for post-graduate students at the Academy of Catholic Theology in Warsaw is of considerable interest to anyone else engaged in a similar programme.[1] However, I would suggest that the comprehensive multi-disciplinary nature of that course could prove daunting to anyone with more limited experience who is yet interested in forming or supervising a similar programme. Conservators who could run such a course certainly exist, yet most would feel very strongly that practising conservation work is of greater importance not only to themselves but to the many works of art in need of attention than devoting a considerable amount of time to art history students, only some of whom may enter the museum profession. So, it is likely to be others who will run such courses and I would suggest that the danger of dilettantism that Hanna Jedrzejewska fears can be avoided by devising a more limited programme than hers that will yet be of value.

Before giving an account of my own experience in running a conservation/museum studies course for art-history students, it will perhaps be best to consider who the participants in such a course might be, for the term art historian or art-history student may indicate a person at one of a variety of levels - the museum curator, the postgraduate student on a museology course whose principal aim is to enter the museum profession and the undergraduate who has an interest in the subject but whose final aim may not yet be formulated.

In the case of museum curators and postgraduates engaged in a museum studies course, their objectives - to collect, to conserve and to educate, should be clear and the importance of conservation work should certainly be appreciated. In my experience, young members of the curatorial profession with whom the lecturers on the Gateshead diploma course in conservation come in contact are very sympathetic to conservation and the care of their collections. In a country of relatively small size such as the United Kingdom, which has an active professional body in the United Kingdom Institute for Conservation, it is generally true to say that there are possibilities for many young curators to visit conservation studios and to build up a rapport with conservators. Even if such curators had no opportunity for a study of technical matters during their University career, they may be able to acquire some of the information they need at a later time. In other countries of greater area and more scattered population this may of course be much more difficult and there one could argue an even stronger case for the inclusion of technical subjects in an art history curriculum.

I believe that one may assume reasonably strong motivation for learning about technical aspects of the care of collections on the part of art historians who are museum curators or postgraduates on a museum studies course. Although the students for whom Hanna Jedrzejewska's course was formulated do not come exactly into either category, many are priests who will have a direct responsibility for caring for the art treasures in a variety of institutions. Therefore one would expect the same motivation from them as from postgraduate museology students and could plan accordingly. Also, the varied nature of the objects that are likely to be in their care entirely justified the wide range of the course. However, undergraduate students have less motivation and, in my experience, a technical course has therefore to be formulated differently.

Most art history students at first-degree level have a very lively interest in anything connected with the arts but the majority have not usually decided upon a particular profession. Their strongest motive is generally to obtain a good degree at the end of three years of study and many postpone a decision or active moves towards a career until the third year. Another point to bear in mind is that such students are of widely varying ability from the technical and practical point of view; some who take part in a technical course as part of their studies may in fact be totally unsuited to it. This combination of factors means that most of the students participate with less dedication than one would expect from a postgraduate student in museum studies, and indeed, the teacher must be prepared to accept this.

These general remarks are based on the author's experience over six years as Senior Lecturer in Conservation at Gateshead Technical College, spending several hours each week on lectures on the history and properties of materials to students taking a full-time course in conservation of easel paintings or works of art on paper but also devoting part of two or three days per week to students taking the B.A. Degree in History of Modern Art and Design at Newcastle Polytechnic.[2] The Polytechnic course is designed in such a way that academic work occupies four days per week while much of the fifth day is occupied by a practical option which is obligatory in the first and second years but truly optional in the third year. The practical options, of which Conservation/Museum Studies at Gateshead is one, are intended to provide opportunity for work of a practical nature. They do not form part of the degree examination. Doubtless this results from a recognition of the fact that students who have chosen to take an art history course are more likely to have academic ability than practical expertise, but the fact that the work undertaken in the practical option is not examined certainly affects the motivation of some students. Having said this, it should perhaps be mentioned that a few students who select the conservation option have previously taken one year at art school, while a few more have taken practical art to a high level at school until the age of eighteen, and these are the students who usually make the most of the course. Other students of lesser practical ability who still profit by the course are usually those of particularly high intelligence who are well organized; they appreciate what the course can offer them and organize their academic studies so that they fit in time for the practical option without difficulty.

At the beginning of the academic year new students are given three to four weeks to select one of the practical options. It is usual for them to visit the studios over that time to meet the lecturer, see the facilities and view work done by previous students on the course. The students select their practical option; the teacher has no choice of students.

At this point the question of ethics arises. The inclusion of the word 'conservation' in the title of the course leads some people to think that conservation or restoration work is actually undertaken by the students. This is definitely not the case and it is always necessary to point out the fact to the students before they decide which practical option to choose. Sometimes students who have expressed an interest in conservation as a career decide against taking the course when they learn that they will not be allowed to attempt any conservation or restoration work. From the author's point of view it would be most unethical to permit any student who attends a class only three or four hours per week to attempt any treatment of a work of art. Training as a conservator requires continuous application and practice under the supervision of an experienced conservator over a long period with the benefit of supporting studies in science and art history. To major in art history and put in a few hours of practical work in conservation is totally unacceptable and this is strongly emphasized to all potential students. Although this has the effect of deterring some completely, it seems best to have complete understanding on the part of the group as to exactly what they will or will not be allowed to do. Those who decide to embark on the course appreciate the ethics of the matter and so accept the limitations of the course and the fact that it is rather more structured than some of the other practical options open to them.

Constraints on the structure of the course are therefore the following:

i. ethical considerations
ii. the level and varied ability of the students
iii. the scope of conservation work undertaken at

Gateshead

In connection with the third point, the Gateshead full-time conservation course is concerned only with training on easel paintings and works of art on paper. These are the fields of conservation work that the Newcastle Polytechnic art-history students are able to observe on a regular basis and their own course is therefore constructed around work in these areas. Other disciplines are touched upon only when museum visits include a tour of other conservation studios in the district, as, for example, the conservation of archives or archaeological artifacts.

Bearing in mind that the art history students are at an early stage of their course and most of them have not decided upon a career, they are nevertheless treated as if they may one day decide upon a career in curatorial or conservation work, as some of them ultimately do. The teacher's object then is to prepare them for this possibility in the full knowledge that they will require further, specialized training before entering either profession. Basically, therefore, the aim is to instil in all the students an understanding of the materials and techniques employed in paintings and works of art on paper, for without a real appreciation of materials and techniques it is not possible for the art historian to understand the causes of deterioration, to recognise the nature of various problems, and to appreciate what may be possible in the form of conservation treatment.

This is really the most basic form of technical education that all art historians require whether they are going into museum work or not. I believe that many art history lecturers realise this but are not able to offer it because they have not received the necessary training themselves.

In the Conservation/Museum studies course devised for Newcastle Polytechnic students the programme commences with a study of the materials and techniques used in works of art on paper. Instruction is included on the nature of paper and causes of deterioration.

The students are required to complete drawings in a variety of media, including metalpoint, ink, charcoal, crayon and pastel, and to consider the possible limitations of various media and particular problems that such drawings may present to the conservator. For the ink drawing they make up iron gall ink and have the opportunity to experiment with reed and quill pen as well as modern steel pens. The students are required to keep their work so that they may observe subsequent changes, as, for example, the change in colour of a copperpoint drawing or iron gall ink. Whenever possible this practical work is related to work being undertaken by Gateshead conservation students in the adjoining studios. For example, if there is a drawing in the studios in a medium that the art-history students have been using they are invited to see it and the conservation student explains what difficulties may have been encountered in treatment. (Apart from instruction for the art historians, this is good practice in communication for the conservation students.) Illustration of the necessity for protecting an inscription in iron gall ink before treating a print is usually included also. It is in fact very necessary to illustrate this sort of point. One can explain the matter in class and the students realise that their own iron gall ink drawings are water sensitive, but the opportunity to view a museum object in which the properties of a particular material must be considered is a great help in achieving thorough appreciation of the point under consideration.

Work in aqueous painting media is included. Experiments are made in a variety of media that the students prepare themselves - glair, egg yolk, glue and gum. Fading tests are conducted with commercially prepared transparent water colours, gouache and drawing inks. Owing to the deliberate inclusion of colours of widely differing permanence on the part of the lecturer, this exercise provides an experience which, judging by the reaction of the students, seems unlikely to be forgotten. Once again it is clear that it is not sufficient merely to tell the students something; they must see it for themselves and this can be done without putting any museum possession at risk. Of course, the results of the experiment must be related to the type of pigments and traditional mixtures used in watercolours in the past. This can often be done by reference to watercolour drawings in the conservation studios or by reference to the slide collection illustrating works that have been treated at Gateshead over the past twelve years.

Instruction is given in the history of printing techniques and print recognition. The latter is supported with the opportunity to examine a collection of prints in a variety of techniques together with the plates from which they were made. This examination is usually undertaken with a binocular microscope, thus introducing the students to one method of technical examination. When a suitable opportunity occurs they are also introduced to the uses of examination by normal, raking and transmitted light and the use of an ultra-violet inspection lamp.

Adhesives used in paper conservation are considered and the students make up several adhesives. Methods of mounting are considered and they have the opportunity to mount some of their own work At this stage a visit to a framer and mount-cutter in a museum studio is likely to be included so that they may see a variety of specialist equipment and traditional techniques such as the production of a line and wash mount.

The work on materials and techniques employed in works of art on paper that has been described here in some detail takes at least two terms. Since the course is essentially practical in nature, the students are not required to undertake a lot of reading although frequent reference is made to a number of books. The students are not really at a stage where they may make an independent critical assessment of information in some books and it seems best therefore for the teacher to select various points from a book such as The Curatorial Care of Works of Art on Paper by Anne F. Clapp rather than asking the students to read it with the consequent risk that the information it contains might be misused by the over-ambitious.

Following work on paper students usually progress to the preparation of a wood panel for tempera painting applying glue size and a gesso or chalk ground. Each student normally traces the design from a reproduction, transfers it to paper in order to undertake a tone drawing in ink and then repeats the process on the prepared ground. They are encouraged to copy a detail from a design that includes gilding so that they may practise this technique. Then the painting is carried out in egg tempera. Various stages of the exercise are related to work undertaken by the Gateshead conservation students, and even accidents, such as the dissolving of a small area of gesso ground by one art-history student who then had to fill the loss, can provide a useful object lesson. However, the whole process of the tempera panel takes many weeks and it is at this stage that the less able or enthusiastic second-year students sometimes become discouraged and tend to lose sight of the fact thet they are practising many techniques that the Gateshead conservation students employ, an important difference being the fact that the art history students are working on their own production not a museum painting.

Students have the opportunity to progress to a similar study and practice of oil painting and may stretch a canvas and make a practical study of different coloured grounds, various oil media and varnishes and the different effects that may be achieved with them. The practical work in easel painting techniques is associated with discussion of causes of deterioration, demonstration of methods of technical examination and observation of the paintings undergoing treatment in the conservation studios.

Practical work of the nature described above occupies most of the students' time on this technical course. Its relation to conservation needs and the work to be seen in the conservation studios is constantly emphasized. Museum studies form a smaller proportion of time spent by the students but it is, nevertheless, an important part of the course. A very high proportion of the works of art in the conservation studios at Gateshead are owned by museums and art galleries and it therefore makes very good sense for the art history students to see the conditions of display and storage in some of the museums. A study of the environment and use of environmental monitoring equipment is most meaningful if it is conducted in a museum. Also, since the students do not undertake conservation treatment they cannot undertake conservation documentation but this course of study is such that they should be able to identify various materials and techniques, so they are given a talk on museum registration methods and the practical experience of completing Museums Documentation Association forms. Other museum visits have a specific subject of study, such as security, a museum education department, a small local museum or a department of archives.[3]

If compared with a course of museum studies at postgraduate level, this element of the Conservation/Museum studies course for undergraduates may appear superficial. However, as the practical work undertaken by the students takes place entirely at Gateshead Technical College, it is desirable that the students should fully appreciate not only its relation to conservation studios there but to the museum world in general. Furthermore, it enables those students who think they might like to apply for a postgraduate course in museum studies with a view to entering the museum profession to make a decision on an informed basis. Lastly, for those students who lack practical ability and therefore find parts of the course very demanding the museum visits form a welcome change from time to time.

One must remember that this course of technical nature is not an examination subject. It is followed by the students by choice, usually they form a small group, normally around four in number, never more than six. Fortunately the small size of the group makes it relatively easy for the teacher to make minor adjustments to the programme according to student interests and it facilitates the students' observations of work in the conservation studios, also enabling some mixing between the art history and conservation students. (Members of a very small group are more likely to be received as individuals rather than as an anonymous group of students from another college.)

The art history students have the opportunity to develop an interest in technical matters, to compile a portfolio showing evidence of practical work and to acquire information that may assist them in choice of career. Some have proceeded to further full-time training in conservation. The course should also provide a measure of enjoyment as well as a challenge; the fact that in some years one or more students have chosen to continue with the course in their third year even though there is no compulsion to do so is some measure of its success.

In conclusion, one cannot ignore the warning cry 'a little knowledge is a dangerous thing' that comes from many conservators whenever a course of this nature is mentioned. The ethical basis of the course must always be upheld by the teacher, who must constantly be aware of the potential dangers and who may have to be ready to resist requests from students or some pressure from art history lecturers to alter the content of the course towards greater involvement in practical conservation. In my opinion indiscriminate reading by students is to be discouraged and it is best to avoid full-scale demonstrations of particular conservation techniques since either may encourage a student to consider that a process seems easy and to suppose that a particular treatment would be equally suitable for a number of works of art. From this point of view, the proximity between the Newcastle art-history students taking the technical course and the Gateshead conservation students is valuable, as the art historians make observation of work that is often in progress over a long period. If they do not realise already, the Gateshead conservation students will soon tell them that conservation involves demanding, complex and sometimes lengthy procedures.

Clearly, any conservation-related technical course for art historians may be varied in content and character not only with relation to the level of the students but also the experience of the teacher. The importance and responsibility of the teacher is particularly great as the ethical basis of such a course must never be eroded. Yet another important feature is the association of any technical course with museum and conservation studio so that the subject forms an integrated whole in the minds and experience of the students whatever their level.

References

1. Hanna Jedrzejewska, 'Technical matters in art-historical curriculum', ICOM Committee for Conservation 5th Triennial Meeting Zagreb, 1978, 78/22/2.
The same author's 'Care and Protection', International Committee for Ethics in Conservation, Stockholm, 1978, contains details of the syllabus of the technical course offered at the Academy of Catholic Theology in Warsaw.

2. Details of the diploma course in conservation for full-time students are included in the author's 'Conservation training at Gateshead - the past ten years', ICOM, Zagreb, 1978, 78/22/1.

3. Collaboration between museum and college results from a very close connection with Tyne & Wear County Council Museums which comprise a group of museums and art galleries in Newcastle upon Tyne, Gateshead, Sunderland and South Shields. The author would like to acknowledge the helpful co-operation of the Director, Mr J.M.A. Thompson, and all his staff.

81/22/4

THE EDUCATION OF CONSERVATION PERSONNEL IN NORWAY

Erling Skaug

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

THE EDUCATION OF CONSERVATION PERSONNEL IN NORWAY

Erling Skaug

Norsk Folkemuseum
Oslo 2
Norway

ABSTRACT

The training procedures of the last twenty years are described. While all are based on in-training, notable variations from one branch of conservation to the other occur, and the lack of co-ordination is pointed out. A new program is being proposed this year, the main features of which are outlined. Among its aims are the improvement of theoretical subjects without relinquishing the advantages of practical studio contact, rationalization of teaching, equality for all branches, and a possibility of formal integration with academic education as well as with relevant crafts.

1. PRESENT SYSTEMS

The current training of restorers in Norway is based on internships in the conservation departments of the larger museums. Depending upon the particular branch of conservation, standards vary with regard to admission level, length and content of training program, and whether or not some sort of examination takes place during or at the end of training period.

a) Conservation of paintings

As in most western countries, this branch is relatively well-established, with the greatest number of specialists and the most favourable formal framework for training and career opportunities.

In 1960, the Norwegian section of the Nordic association of restorers (Nordisk Konservatorforbund/IIC Nordic Group) defined a standard for membership, comprising length and content of study and a final examination.

In 1965, the four largest museums agreed on a training program for painting restorers based on this standard, which was subsequently approved by the Ministry of Education. By making the successful completion of this program compulsory for anyone applying for official employment in Norwegian museums, it was thus established as the first nationally formalized restorers' training program in Scandinavia.

The program of 1965 can be outlined as follows:
Admission: Matriculation examen, or equivalent.
Duration: At least 5-6 years, depending on previous qualifications, like art school or a lower degree in art history (most applicants have one or both).
The study is a paid internship throughout. It takes place in one or more of the established museum conservation departments, and includes a stay abroad of preferably ½-1 year (mainly in Germany, Belgium, Italy, England and/or one of the other Nordic countries).
Program: Combined practical work and theoretical study. Continuous studio training is considered essential, supplemented by part-time afternoon studies at art school (4 semesters), chemistry (2 semesters, with exam), and art history at university (1-3 semesters, university exam not compulsory, may be replaced by an oral examination). Those who already have, for example, art school or art history, are naturally excepted and may complete the whole study after a minimum of 5 years.
Shorter courses and seminars, e.g. in photography, IR-, UV-, and X-ray examination (w. exam) are interspersed. Technical history of painting (1 semester) is taught at two or three-year intervals for art history students and conservation students jointly. A curriculum of the basic international literature (3-5000 pages) must be absorbed mainly by self-study.
Evaluation: Internal evaluation after the first year, the student's competence to proceed being decided.
At the end of study, a restored work of art, with a written report, is submitted to a committee of three members (one art historian and two painting restorers, appointed by the Federation of Museums, the Norwegian section of NKF/IIC, and the candidate's institution, respectively), and an oral (recently also a written) examination is undertaken.

b) Prints and drawings

The painting restorers' training model has later been adopted by this branch, with the adequate adjustments. The first successful candidate passed in 1973. Study periods abroad for paper restorers usually include England and Austria.

So far, this training only takes place in the National Gallery, Oslo.

c) Library and archival material

Unfortunately, no co-ordination has yet taken place between the training for this branch and the one for prints and drawings in museums.

Conservation in archives has a long tradition in Norway based on the recruitment of bookbinders, who receive in-training at the initial stages of employment.

In 1977, a preliminary plan was outlined for the use in the 7 state archives:
Admission: 2 years of craft training (bookbinding).
Duration and program: 3 years of internship, where courses in lamination, pH-measurments and deacidification, climate control etc. will be given.

d) Textiles

Since 1930, The Museum of Arts and Crafts in Oslo has set the following requirements for the employment of textile conservators:
Admission: Basic training in textile crafts.
Training: 2 years of in-training in textile conservation in Sweden, which has had the longest tradition and the highest reputation in this field among the Nordic countries. More recently, the studies abroad have been extended also to other countries, such as Switzerland, France, and England.

In 1978, a majority of the country's textile restorers adopted a training model parallel to the one for painting and paper restorers. Basic training in textile crafts is still a prerequisite.
While this scheme is for the moment formally the specific membership standard in the Norwegian section of NKF/IIC, it is not expected to be in actual operation until internships again become available, which for lack of funds they are not at present.

e) Archaeological material

Like conservation of paintings, this branch as a specific museum task has traditions reaching back into the last century.
The archaeological museums in Norway belong to the universities. The formal responsibility for their conservation laboratories is as a general rule entrusted to chemists, who usually must organize and conduct the treatment of excavated material on a large scale. Members of the conservation staff are selected on the basis of individual qualifications and receive initial in-training as technicians.

From 1966/67, 1971, and 1974, respectively, separate training systems within the different archaeological museums have been adopted. Both training and subsequent

employment do as a rule take place in the same institution.
Duration: 3 or 4 years.
Programs have included chemistry, physics, mathematics, and English (curriculum for matriculation examen), furthermore archaeology, prehistoric technology, materials, climate, methods of examination and conservation, casting etc. Curriculums of basic literature have been made. Practical conservation in the museum laboratories throughout, and participation in field work.
Evaluation: According to the system of 1974 (Stavanger), two evaluations take place. After the first year, the trainee's competence to proceed is considered. At the end of the study, a committee (consisting of the curators in charge of the archaeological conservation departments) evaluates a treated object/solution of a conservation problem, with a written report.

Like the textile restorers, no internships are presently in operation in any of the five archaeological museums.

f) Etnographical/cultural-historical material

This branch (which basically deals with the same groups of material as the one above) is the one most closely associated with traditional crafts. This is obviously the general situation in many countries.

Most of the personnel entrusted (full- or part-time) with restoration in our numerous cultural-historical museums are craftsmen, usually highly skilled, but with little other training. Methods and ideas of treatment are more often than not confined to those of conventional repair and maintenance.

One single, local attempt is being made to apply a modification of the painting restorers' model to the situation, but the dimensions of the problems in this field are vast, and expert resources are lacking.

Conclusion

- The availability of qualified restorers does not meet the demand, and significant changes in the situation cannot be expected under the present circumstances.
- Actual training opportunities vary considerably from one branch of conservation to the other.
- Closely related branches, such as paper in museums and archives, have not yet succeeded in joining aims and teaching resources across the institutional borders.
- Differences in organization of conservation units give differences in status and career structures. For example, painting restorers are placed in charge of painting conservation departments (with salaries practically at curators' levels), while chemists/curators with no previous training in conservation are placed in charge of archaeo-

logical conservation departments. In the latter case, the trained staff personnel cannot rise to leadership positions. This influences the recruitment patterns within the respective branches.

- A general and well-known experience with all the internship systems mentioned above is the difficulty of conveying the desired amount of theoretical information.
- Because of the renumeration involved in the internships, some institutions also tend to regard the trainees as working power rather than as students.

2. FUTURE PLANS

The present situation has long called for a co-ordination of the training and a revision that could meet the varied demand for conservation personnel.

In 1978, the Ministry of Education appointed a committee with a comprehensive six-part mandate concerning a nationally organized structure for conservation activities. One part of this commission was to propose a new plan for the education of conservation personnel. According to the mandate given, the committee was to consider

- a delimitation between the various branches of conservation, with regard to common studies and specialization;
- the institutions suitable for training programs;
- recommendations for the duration and contents of study, and for its level of competence;
- possibilities for Nordic co-operation;
- and in particular consider how such a study wholly or in part can be integrated into the already existing educational systems in the country.

The committee will submit its report this year. On the basis of the experiences with the present systems, the committee suggests what may be called a school organized directly under the Ministry as an independent unit, but operating in close collaboration with the museums.

The complete training of the model proposed comprises three consecutive steps, (A), (B), and (C):

(A) Broad introductory study, 1 (1½) year.

Admission: As for universities and high schools (these admission rules have recently been liberalized, in order to reduce the formal barriers for people with a craft's background).

This step is common for all branches of conservation, and consists of more or less traditional class-room teaching.

Subjects are I) basic chemistry, II) introduction to materials and their causes of deterioration, III) climate, storage, and transport, IV) introduction to scientific methods of examination (and including a course in photography), V) documentation, VI) museums and their organizations, legislation, introduction to history and philosophy of conservation and restoration, and VII) a broad outline of cultural history, with emphasis on objects, and including such topics as style and technology.

No actual conservation is taught at this stage. The double scope of step (A) is to create a mutual esprit de corps between the various branches, and to rationalize some of the teaching.

It is proposed to give this stage a formal level equivalent to a lower university degree. It should be open also to students other than the restorer-to-be, for example the art historian or ethnologist who aims at a museum career.

Evaluation: Exam(s).

A few months' volunteer work in a museum studio or laboratory is suggested between steps (A) and (B), or as shorter periods within (A) (this accounts for possible prolongation of (A) to 1½ year). Such a period may give both the potential student restorer and the administration of the school a better opportunity for mutual evaluation.

(B) Basic specialization. 2 years.

Admission: Successful completion of (A). The selection furthermore takes into account other relevant qualifications and personal qualities.

At this stage the particular branch of conservation is chosen, i.e. either archaeological material, ethnographical objects, textiles, paper or paintings.

The study will be given a "sandwich" structure, i.e. shorter block courses and seminars alternating with practical conservation work in museum studios and laboratories.

A number of adequately equipped and staffed museum conservation departments will be selected within the various branches, - i.e. mainly the larger museums already engaged in the present training functions. Contracts between the school and the museums will be made, with regard to the number of students and the museums' obligation to provide them with suitable conservation tasks according to the progression of the course program. Responsible supervisors in each studio/laboratory will be appointed from the museum's own conservation staff. These supervisors serve as connecting links between the school and the museums.

Final evaluation: Submission of a journal from the 2 years of work. Submission of restored work, with a written report. Examination.

Completed (A)+(B) qualifies for assistant (technician) positions. Independent positions cannot be applied for without additional practice (c. 2-3 years) in a studio or laboratory.
For positions of chief restorer (head of conservation department) a higher degree (C) must be held.

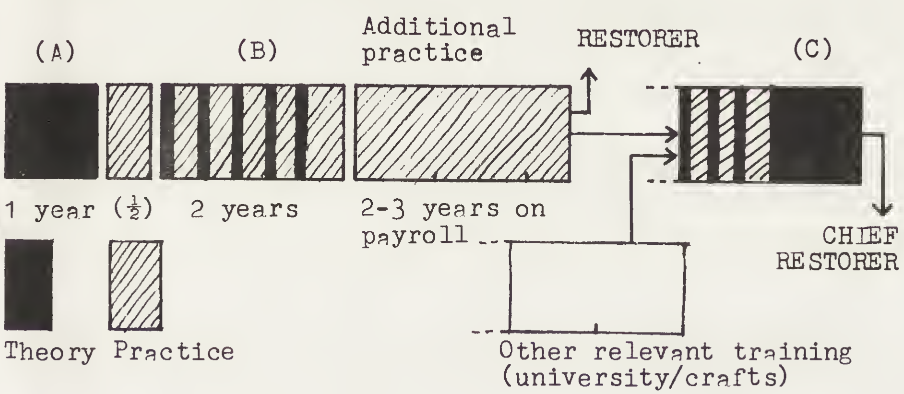
(C) Higher degree

This stage presupposes additional practice, as mentioned above. It is not possible to go directly from (B) to (C) (the additional practice should be ensured by making available assistants' positions for limited terms of 2 or 3 years).

At this stage credit may be given for other relevant training, such as a university background in the field of specialization, or arts/crafts' training (3 years of art school equivalates a lower university exam of 1 year). Combined with the conservation subjects (A)+(B), the restorer's total formal qualifications may thus, after a fixed credit system, allow him to embark on a project leading to a higher academic degree (equivalating M.A. or Ph.D.).

Chief restorer positions at the regular curatorial level must be opened for this category of personnel.

DIAGRAM OF TRAINING MODEL
(According to the majority of the committee)



Final remarks

The model sketched above has some disadvantages.
It will draw heavily upon the few museums with well-equipped conservation departments, and the initial growth in personnel may be slow. Only in a few branches, competent staffs and resources will be able to fill the teaching programs

indicated. Here is where Nordic (and other international) co-operation may come in.

Among the advantages should be mentioned the low cost, compared to the expenses of equipping an entirely new school, and it can be realized for some branches in the near future.

The model is flexible, and may easily be adjusted to fluctuations in the demand. Almost all the teachers will remain in their museum positions.

81/22/5

PROBLEMS IN THE TEACHING OF CONSERVATORS: PROPER WORKING HABITS

Hanna Jedrzejewska

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

PROBLEMS IN THE TEACHING OF CONSERVATORS: PROPER WORKING HABITS

Hanna Jedrzejewska

Solec 109a /39
00-382 Warsaw
Poland

ABSTRACT : The ultimate aim in teaching conservators is not just to produce more people with professional diplomas but to ensure a good preservation of cultural heritage. To achieve this goal it is not enough to feed the student with theoretical knowledge and develop his practical skills. Even more important is a proper formation of his attitudes and working standards. These matters are only seldom included, if at all, in study programs and training activities. They are briefly reviewed in the presented paper.

x

x x

The matter of proper working habits is of first importance in the teaching of conservation. Quite often the graduates come out of their studies very clever, skillful and sophisticated, but at the same time hopelessly messy in all their doings, and ignorant even of the simplest matters of programming, planning, systematic organisation of work, responsibility, professional ethics, etc. They feel no need for further development, for methodical reading and experimentation. Sometimes they just feel too "artistic" to bother about being tidy in their work or to keep systematic notes and records. Such attitudes and habits lead to professional incompetence and irresponsibility, and are a source of dangerous menace to treated objects. To avoid the development of bad habits it is necessary to train the students in g o o d habits, in a very consequent way, all the way during their studies. And this is quite a problem for the teacher ! He has to find different ways of approach to make the student understand that proper working standards are a matter as important, or even more, to his profession as his skills and knowledge. Implanting these habits is very much a matter of psychology (the student has to w a n t) and of personal example given by the teacher.

BASIC HABITS

Habits may be defined as things so well intrained that they become almost automatic,a kind of second nature. They are very much determining the ways of thinking and of acting, and may be divided into several particular groups.

Cleanliness and orderliness :

This mostly concerns matters of workshop and working area. How often one can see badly organized working areas,general disorder,heaps of things deposited on floors,lack of organisation in cupboards,etc.In films and on slides showing examples of treatment of very precious objects the backgrounds undiscreetly expose the lack of order in the workroom .On working tables not rarely messed are,all together,treated objects,tools,coffee cups,cakes,lunch,ladies purses and handbags,lipstick,scarves,gloves,ash-trays, cigarettes,matches,solvents,cotton-wool,paints,scalpels, brushes,dirty palettes,notebooks,etc.,etc.Quite often bottles with chemicals are standing directly on treated paintings,used cotton-wool is thrown to the floor,books and journals become stained,and glass and pottery "have accidents".No protection from damage,clean and dirty things are not kept separately,dust and spiders feel at home. We all know that picture too well.

The task of the teacher will be to enforce,consequently,a very rigid regime of keeping systematic order in the whole environment connected with conservation, and also in drawers,cupboards and working table.A teacher that himself is messy will have difficulties in keeping students well in hand.Anyway,it will be the matter of the teacher's ingenuity to find the best methods to instil the necessary habits of cleanliness and orderliness.

Regular reading habits :

There is a Chinese proverb saying that "ample reading is a very great treasure".But how often one can hear from people "yes,I have this publication in my library.But I have not had,as yet,time to read it.I am so extremely busy.But I will certainly read the thing when work stops being so crowded!". That obviously means n e v e r .Publications have to be read (or at least well perused) immediately when they come,so that the reader will more or less know what the thing is about. This is for constantly building up the general knowledge.

Generally,the purpose of reading may be twofold: 1/ to look for some actually needed particular information, and 2/to know what happens in the field. Reading has to be accompanied with systematic bibliographic notes.The situation :"I have read about i t recently,but am unable to recall where it was" ,should happen as rarely as possible.

Reading has to be regular,systematic and well organized.It must be a habit and a pleasure.A bit of a hobby with a hunter's instinct.Occasional hunting in the library for some specific information may give unexpected satisfaction /1/.

Professional reading has to be learned.The student has to become aware of the contents of his nearest library (possibly at the school),of who the authors are, of the necessary critical attitude towards presented views and informations,of the most effective ways for making notes and classifying the information. He has to be started in the proper way.This is the task for the teacher. He has to assist students in their first visits to the library.Afterwards,he must give to the students some specific problems to be solved on the base of published informations,with the final task of presenting the collected material on a seminar.In this way the student should make reading his regular habit,and find it very helpful.

Constant learning :

The conservator should not go only on information collected during studies.There must be a constant effort to gain more information and to better the practical abilities. So,besides regular reading the conservator must meet other specialists to exchange views and experiences,see different workshops,participate in congresses ,and publish his own papers.

Not only reading but also writing is a very essential part in the process of learning.Besides occasional papers and reports there are the daily reports and notes, and also advanced planning and programs for treatment. These also should be made in written form and serve,later on, as reference material.

But writing takes much time and who likes it.When it is well implanted and becomes an automatic habit,it is less objectionable.Again,a hard task for the teacher to instil this habit.This time maybe a scientist will do better than a technician,as he may also give methodological directives on the proper organisation of written texts.

Critical attitude :

There is an enormous diversity of opinions,motivations, possibilities and suggested methods.A conscientious conservator has to be always suspicious as concerns methods and opinions and have a critical attitude towards e v e r y t h i n g concerning matters of antiquities.

This critical evaluation always will have more value when done b e f o r e than a f t e r treatment. In the first case it is possible to prevent making mistakes ,in the second there is the classical situation of learning on one's own mistakes (means ruining something in order to give better treatment to the next case). A critical assessment of everything has to be inseparable from the conservator's daily routine.It bears also creative elements in the search for better solutions than the ones critically evaluated.

But critical and creative can only be a conservator that has large experience and knowledge,also through extensive reading,and initiative in looking for problems. It may seem strange but also here very strict implanted habits are necessary.In this way critical assessments can be almost automatically made.

On the other hand,towards uncritical attitudes are leading uncontrolled ambitions,uncritical fascination with one's own achievements,fascination with new well advertised products without critical testing,etc.

The role of the teacher is very difficult here. He himself must have a good critical disposition and experience.Of help are here different kinds of seminars,discussions of cases,and "simulated games" with subjects adapted for critical considerations.

Imagination and responsibility :

This generally is connected with matters of protection and safety,as well of objects as also of human beings. Included here is also the safety of the conservation laboratory and of its equipment.

Imagination,backed by knowledge and experience, is necessary to foresee things that may eventually happen. Responsibility means ,in a practical way, actions done to prevent the anticipated things happening.So,the conservator has to be constantly observant and reactive. It has to be his second professional nature,and this immediately points out to another deeply ingrown habit, concerning as well small as basic things.

These reactions should not be restricted to the conservator's own laboratory ,but to anything,anywhere. The task of the teacher is here mostly to provide good "training material" ,with properly chosen simulated games,discussions,subjects for written tests,and "innocent" traps laid in convenient places.

Ethics. Methodology :

The conservator is as a rule considered to be a cultural person.This means,among others,a deep respect for any old object and for the evidence it brings from the past. This respect has to be maintained during all operations in conservation ,notwithstanding the object's type and value.It is the main principle of ethics for all conservation treatment.It is sometimes difficult to instil this principle into the minds of the students,and to make it stay as another ingrown habit.

Closely connected to ethics is methodology,a subject not included in lectures and only rarely touched in particular cases.Methodology in fact means a combination of methodical and logical,systematically arranged,ways of thinking or acting.It needs a clear statement of the purpose of the undertaken task,followed with basic definitions,principles and factors of influence, and ended with precisely formulated conclusions.This logical order,when applied to procedures of conservation, helps in keeping a consequent program of treatment.

Implanting proper ethical principles needs a teacher of high ethical standards himself.The introduction to practical methodology should rather be in the hands of a research scientist.In this way the students will learn some basic facts about writing lucid reports and papers. At present this thing is far from satisfactory.

COMMENTS ON HABITS AND TEACHING

Methods of implanting proper habits are a very individual matter and must be adapted to given conditions connected with the school,students and teachers.But there are some common factors applicable to all cases :

1/ it is a known fact that the first acquired habits are the strongest.So the procedures of implanting proper habits have to be started at <u>the very beginning of teaching</u>. It is almost impossible to "undo" the early acquired bad habits.So,the beginner must be very carefully guided during his first steps in the new profession.

For that reason it may be very dangerous to take students that already have had a "preliminary practice" in conservation at some other place.Quite often also,especially when taking students to the lower technical grade,it is the practice to start training with purely manual operations without building at the same time a proper background of good habits on the respective level. This may prove to be irreversible in effects.

2/ the habits of systematic reading have to be well implanted .This even may need learning some foreign language.The procedure of reading has to start early and go on all the time.It should not be treated as only an occasional effort, for example just in the last semester on the occasion of preparing the final thesis.

To become an experienced dedicated reader the student needs guided training introducing him not only to the bare technique of reading but also to the pleasure of "hunting" for information.

The teacher must be an expert reader himself and have a good,modern and representative library.As concerns very voluminous text-books,with all information already collected,classified and commented ,they are of more use to experienced readers.On beginners they may just act as "wet blankets" killing all the joy of hunting.The teacher must be well aware of this and adequately fill his library with journals,encyclopedias etc.

3/. As already mentioned the matters of implanting proper professional habits have a strong psychological background. Some people have a natural tendency to be systematic,reliable,keep order ,be well organized.But everyone reacts differently and has different predispositions.So,the implantation of habits has to be adjusted to each individual student so that he will positively respond and not rebel against the necessary discipline.

A lot will depend on the student.There are people orderly by nature or hopelessly messy.These characteristics or other psychological predispositions have to be well checked before admitting the candidate for study, by having special tests prepared for this purpose.

4/ The importance of "simulated games" for the development of imagination and reactivity can not be underestimated.It is a very good and attractive training for future authentic tasks, of course if properly devised.

There is freedom to make errors and mistakes,as many as will come out.The students are learning to anticipate possible events,dangers and difficulties .No fear, that something may go wrong.It even is good to arrive at impossible situations or catastrophic solutions.The better the chance that this will not be repeated in a real case.

5/ matters of ethics,good habits and methodology are sometimes treated with the students with a certain amount of disdain,as too "philosophical",unbecoming to the creative profession of the conservator.But they have to understand that conservation is just a very specific field where art,philosophy and technology have to blend to a consistent whole.

The student has to accept this fact.He not only should have proper habits as a permanent element of everyday's practice but also have them included in the final examinations.

6/ there also are purely didactic questions.Should the matters of habits be openly discussed with students or even be made as lectures?Or should they just be gradually and discreetly introduced without too much fuss or talking? Or maybe ridiculed by caricatures or films ? Here the teacher must be a good intuitive psychologist and strategist.

The general answer will be : all depends on the student,the teacher and the particular habit.

FINAL COMMENTS

In all considerations it was taken that a teacher will be constantly assisting the student and have a watchful leading influence. Teaching may also be done by occasional lecturers. In this case there must be somebody with a special responsibility for the proper professional formation of the student. But what to do in cases of self-teaching ? Maybe there is need for a good instructive booklet ?

There are good habits and b a d ones. The good ones have to be cultivated, the bad ones eradicated. A good teacher must have the ability of doing both things.

One may also ask how can the e f f e c t i v e n e s s of teaching good habits be evaluated. The first step is at the time of graduation. But things may be quickly forgotten or the conservator may become "demoralized" e.g. by giving priority to matters of finance and gain. So the effectiveness should once more be evaluated about 10 years after graduation, just to compare how much has been gained and how much lost. But this belongs to the cathegory of "wishful thinking".

BIBLIOGRAPHY

1/ Robert L. Feller. What's in a name: dammar or serendipidity in the library. "The Crucible", Vol.49, No.8,

2/ Hanna Jedrzejewska. Care and Protection. 1978, Stockholm.

In the described program of teaching technical matters to students of art history there is much attention given to matters of "simulated games", with comments and examples.

January 1981

Hanna Jedrzejewska,
ICEC,
Stockholm-Warsaw.

81/22/6

CRAFTS COUNCIL CONSERVATION SCIENCE TEACHING PUBLICATIONS

Helen Wilks

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

CRAFTS COUNCIL CONSERVATION SCIENCE TEACHING PUBLICATIONS

Helen Wilks

Crafts Council
12 Waterloo Place
London SW1Y 4AU
Great Britain

CRAFTS COUNCIL CONSERVATION SCIENCE TEACHING PUBLICATIONS

The Crafts Council's Conservation Section is currently engaged on a major project to produce a series of elementary science textbooks for student conservators (both within museums and outside) and in particular for those with a non-scientific background. This series is being contributed to by a large team of professionals (conservation scientists, conservators, and experienced science teachers) and its preparation is being financed and administered through the Crafts Council's Conservation Section. Work began on the project in January 1980 after meetings with representatives of organisations in the U.K. who have an interest in the training of skilled conservators. A series of paperback books, A4 size with illustrations and some black and white photographs, each book having between 60-100 pages, is being produced and published by the Crafts Council in two stages. The series will form a sequential teaching text and consist of 6-7 books in total. The first three books in the series are already in preparation and will be published in February 1982.

This paper will outline the procedure for preparing these teaching books and deal with the reasons underlying this particular approach for their production.

The Crafts Council

The Crafts Council is a government organisation funded through the Department of Education and Science (Grant for 1981/82: £1,400,000) which is primarily concerned with the work of the artist craftsmen (those who design and make new objects). However, since 1974 there has been a specific commitment to the development of skills relating to conservation. Although the Crafts Council's funds for conservation are small (Grant for 1981/82: £50,500) and are largely spent on projects and grants which facilitate the training of conservators, the contact which the Conservation Section maintains between those working in museum conservation departments, institutions, private workshops, the architectural profession and building firms gives it a unique position for linking conservation activity. The Section works under the guidance of a Conservation Committee whose members are either practising conservators representing particular disciplines or people with specialist knowledge relevant to conservation. With the administrative facilities and resources it has available and by listening keenly to conservators' requirements, the Conservation Section is able to carry out certain projects itself which aim to benefit the conservation profession as well as awarding grants directly to other organisations and individual conservators.

Background to the Series

At the end of 1979, when the Crafts Council's conservation grant schemes had been running for approximately five years the Section undertook a review of its policy and held meetings with representatives from the prinicipal organisations in the U.K. with a responsibility for conservation, several of which, and in particular, the U.K. Institute for Conservation, pointed out the difficulty which many conservators, both in museums and in private workshops, experience in acquiring knowledge of the basic scientific principles relevant to their work. The Crafts Council's attention was drawn to the problems facing conservators in museums wishing to study for the newly established Museums Association Conservation Diplomas and Certificates but who were often relatively isolated in their study and found it difficult to cope with the considerable amounts of conservation science forming part of the various syllabuses. The UKIC suggested to the Crafts Council that a correspondence course along the lines of those organised by the Open University for their degree courses would be invaluable to conservators.

The Crafts Council, therefore, followed up this suggestion, asking advice from several of its Committee members and representatives from various national museums with a large teaching commitment and with conservation scientists on their staff. The need for some elementary teaching texts dealing with the fundamental scientific principles governing conservation practice was expressed repeatedly, both by the large institutions who felt that it would greatly assist them in the training of their own conservators and by conservators themselves in small museums and in private workshops who felt they needed books at a more elementary level than were currently available and, even more especially, angled in such a way that the non-scientist would feel able to learn from them.

The Student

In the U.K. many conservators enter the profession from the arts, coming to conservation with either rusty school science or perhaps having very valuable practical skills but with little or no formal scientific training. Whilst the need for a sound understanding of conservation science amongst all conservators is now beyond dispute, the amount of science necessary to the trainee and practising conservator is still very variously perceived. To the arts trained, conservation science can often be difficult to understand, not only because there are few specialist courses available but also because the more standard elementary science books fail to give the conservator sufficient application to the work. The science called upon by the conservator is very much applied rather than theoretical and at times needs to involve a quite complex and advanced understanding in certain areas and these are not normally covered in introductory science books. On the other hand, conservation research papers and specialist conservation texts often assume an advanced, or at least substantial, knowledge of conservation science. In general, (apart from those on specialist courses) conservators within museums have the most access to formal instruction in the subject but this varies considerably between the large national museums where there are often groups of trainees and conservation scientists on the staff to teach them and the small provincial ones which have very small conservation departments and where there may only be one student supervised by a conservator whose scientific background is limited.

Formation of the Working Group

The Crafts Council soon became convinced that an elementary series would be of great service to conservators in a wide variety of disciplines and that the project would be well supported by those within the U.K. best able to contribute to it. Following our initial informal investigations, and influenced by the methods used at the Open University for the production of their teaching texts, we invited some leading conservators and conservation scientists with experience of teaching conservators to a meeting to discuss a proposal that the Crafts Council's Conservation Section finance and organise the compilation of an elementar conservation science teaching series of books using groups of authors. This meeting was held in January 1980 and representatives from the UKIC and the Museums Association were also present. A general approach for the series was outlined and the aims and level of science to be taught was discussed. The major conservation series being produced by Butterworths, and in particular, the volume on Physical Science for Conservators being written by Dr. Nigel Seeley was taken into account. It was generally agreed that the Crafts Council's series should assume that the student had zero scientific knowledge, that it should be very definitely applied to conservation practice but without specialising in a particular field and that it should, where necessary, advance to approximatel 1st year university level of understanding. It was also felt important that any books produced should be available at a low price helping to ensure that they would be acquired by individual students rather than being used simply as reference material on a library shelf.

Format for the Series

It was established that the format and size of the series should be a total of six to seven paperback books averaging between 60-100 pages per book, each of A4 size. In this way it was felt that no book would become so long as to be off-putting for the student. The large format had the advantage of being standard and also very suitable for accommodating clear diagrams and illustrations. It would also allow wide margins which would be useful for teaching purposes. Black and white photographs or illustrations on each page or double spread with one other colour on some would also assist in making the material clear and approachable for the student.

For financial reasons, as well as to keep the impetus and interest in the end result of the project in sight, it was essential that work moved fairly fast and that we produced the series in two stages. This had the advantage of reducing the number of books being worked on at any one time to manageable proportions and at the same time ensuring that enough books would be available at once to make the teaching message of the series recognisable and valid.

The Problems of Production

Conservators, essentially, whilst knowing in practical terms and often scientifically what such a series should contain (within their own specialist fields), were not sufficiently conversant as scientists to undertake the writing of such a series. The conservator, therefore, represented the consultant or 'customer' and was essential in an advisory and critical role. Straightforward scientists on the other hand, whilst perhaps having vital teaching experience, would not know anything like enough about the practical nature of conservation to make the series a useful teaching document. The conservation scientists employed within several of the major museums and teaching institutions were therefore the obvious choice for authorship of the series. However, even conservation scientists of some experience are not always fully attuned to the difficulties of writing good didactic material for non-scientists - students who have often a wealth of knowledge in technical or craftsmanship terms but next to no formal scientific understanding, or even with a 'block' or fear of learning science.

In trying to assemble a useful working group, I was very aware that all of these factors should be properly balanced and taken into account. It was also clear that any of the conservation scientists (or indeed any other member of the working group) were already fully occupied and that it would be impractical to consider receiving long texts from any one of these people. For all these reasons a team effort seemed the only way forward, but it was abundantly clear that an important supervisory role was not being fulfilled. My own role was an administrative one and wholly inadequate as far as the content for the series was concerned. The Crafts Council needed to find someone with a suitable scientific background and, unlike any other member of the group, fully experienced in writing good teaching material for the type of student we had in mind. Amongst the several suggestions made by the working group for appointing someone to fulfil this role, was the suggestion that we should contact the Department of Materials Science within the Faculty of Technology at the Open University.

The Open University

The Open University was established in 1969. It is a university which organises, tutors and runs degree courses for students (often in full-time employment) studying at a distance in their own homes with the aid of specially prepared text books. It offers degrees in a hugh variety of subjects and prepares television and racio programmes for its students as well as operating short training courses which reinforce and extend the teaching obtained by the student at home.

My introduction to the Department of Materials Science at the Open University through Michael Pascoe provided an invaluable lead. Professor Charles Newey and a senior lecturer from the Department, Graham Weaver, were extremely quick to grasp the aims and objectives of the series and Graham Weaver, who had already done some archaeological research had special interest in the subject. Both were very interested in the educational problems posed by the project and expressed an interest in assisting. They had worked closely together at the OU during the last ten years teaching and producing texts for courses. This experience, coupled with their enthusiasm for the project outlined to them, provided us with the break that we were looking for. I knew it was essential that the 'outsider' to conservation should be very aware of the necessity fo experience within the practice of conservation and be prepared to listen carefully to conservators and conservatic scientists and consult closely with them. At the same time however, it was necessary that an overall view of the projec was provided and this would be more difficult to achieve working from 'inside'. It was important that the scientist fully respected the often very considerable practical knowledge of conservators and provided a means, not of transforming conservators into fully fledged scientists, but into conservators conversant and at ease in the 'langua of science'.

Following my visit to the OU, a programme of visits to several conservation departments of museums and to some private workshops was arranged for Graham Weaver. He spent time talking with conservators and conservation scientists, meeting and having the chance to discuss at some length with each member of the working group. These meetings were productive, giving Graham at least a glimpse of the way in which conservators work and also a chance to discuss a teaching approach for the series with all members of the working group. Several (both conservator and scientist) were sceptical of the use or possibility of making a cohesive elementary text (especially one which could apply equally to all areas of conservation) and it was almost their very sceptisism and doubt which assisted most in the development of a teaching scheme for the series.

The Educational Scheme

Drawing on his experience culled from the OU and from his recent series of visits, Graham Weaver produced a paper outlining an educational approach for the series which was presented to the second full meeting of the working group in July 1980. His paper put forward the following points as the educational aims of the series :

1) To permit access by the successful student to the next higher level of conservation science teaching (e.g. Studies in Conservation, the Butterworth series, etc.) helping them to comprehend at better than recipe level.

2) To encourage speculation about observation so that the scientific method is exposed as a continuously developing framework of useful ideas, not a set of authoritarian dogma nor a directory of facts.

3) To provide a carefully sequenced and graded introduction to scientific theories and language including appropriate symbolism (e.g. chemistry) and mathematics (e.g. graphs) and hence to describe selected phenomena using such concepts as atomism, mechanics and electrostatics.

4) To explain in the context of conservation practice how problems may usefully be described and thought about using scientific models and language.

5) To offer to the student some immediately useful extension of their practical skills.

The paper also discussed in some detail the problems relating to the teaching of science to those with little experience, affinity or else fear of the subject. His scheme focussed on the importance of using the student's practical experience to determine and illustrate the science that it was necessary to teach. The science should not, therefore, be taught simply for its own sake but only as it was necessary or applicable to the conservator's work. In attempting to define a common ground for the series within all fields of conservation, he proposed that the basic activities undertaken by all conservators, regardless of the objects worked on, should act as the key to placing the teaching within an area of familiarity and interest to the student - e.g. recognising and understanding materials and their products of deterioration; cleaning; joining, coating and consolidation

In putting forward this method of approach it was stressed that the books would be neither handbooks to conservation practice or encyclopedias of scientific data. When more complex scientific explanations were required or implied than already taught at a given stage of the text, students would have to be carefully referred on to other more in-depth publications or else to a later point in the series. An early understanding that science cannot always provide a quick and ready answer would be imparted and false simplification of the subject would be avoided by acknowledging clearly areas of complexity. Issues of safety and ethics would not be ignored and students encouraged to evaluate for themselves as they learned, finding a relevance to their own specialist area through carefully chosen examples and exercises.

This approach involved considerable re-thinking of the methods normally used in the teaching of scientific theories and therefore was much more difficult for the authors to write. Long discussion took place on the content for the first three books (those forming the second half of the series have only been considered in outline to date). Despite the difficulties, the working group supported fully the aims and approach suggested by Graham Weaver, and he was appointed by the Crafts Council to take on the role of educational co-ordinator for the series with some assistance from Charles Newey.

Preparation of Manuscripts

Following this meeting Graham Weaver prepared synopses and guidelines for authors working on the first three books. Between two and four authors agreed to work on each book, and during the summer each prepared a more detailed synopsis. These synopses formed the basis for discussion at three separate meetings (one for each book) held between the authors and Graham in early October 1980. At these meetings structure and content was discussed in great detail before the books were divided into manageable sections with each author responsible for preparing the first full length of a particular section. First drafts were written during the final three months of the year and delivered to the Crafts Council at the end of December 1980 in time for work on second drafts to be commenced by Graham Weaver and Charles Newey at the beginning of January 1981 when their consultancy to the Crafts Council began. At the time of writing, second drafts are in preparation by Graham Weaver and Charles Newey in consultation with the original authors and some conservators. On completion of second drafts, reading by conservators and authors will commence in order to provide Graham and Charles with the detailed conservation input ready for the preparation of the third (final) drafts. Work will commence with the designer and illustrator during May 1981 and final manuscripts for two books will be received in mid-July with the third arriving at the Crafts Council at the end of September 1981 in time for the publication of all three in February 1982.

February 1981

APPENDIX

CRAFTS COUNCIL CONSERVATION SCIENCE TEACHING PUBLICATIONS

WORKING GROUP:

Helen Wilks	-	Crafts Council (Chairman)
Graham Weaver	-	Open University) Co-ordinators
Charles Newey	-	Open University)
* Harold Barker	-	British Museum (Retired)
* Michael Pascoe	-	British Museum
* Ruth Boff	-	British Museum
* Vincent Daniels	-	British Museum
* Norman Tennent	-	Glasgow Museum and Art Gallery
* Jim Black	-	Institute of Archaeology
Adrienne Dagg	-	Museums Association
Garry Thomson	-	National Gallery
* Ashok Roy	-	National Gallery
* Sarah Staniforth	-	National Gallery
Anna Plowden	-	Private conservator
Peter Smith	-	Private conservator
Suzanne Keene	-	United Kingdom Institute for Conservation
* Jonathan Ashley-Smith	-	Victoria and Albert Museum
* Anne Moncrieff	-	Victoria and Albert Museum

* Authors

81/22/7

LA FORMATION DE RESTAURATEURS A L'UNIVERSITE DE PARIS I (PANTHEON-SORBONNE)

J.P.Sodini et M.Berducou

Comité pour la conservation de l'ICOM
6ème Réunion triennale
Ottawa 1981

Groupe de travail: Formation des restaurateurs

LA FORMATION DE RESTAURATEURS A L'UNIVERSITE DE PARIS I (PANTHEON-SORBONNE)

J.P.Sodini et M. Berducou

Institut d'Art et d'Archéologie
3 Rue Michelet
Paris 75006
France

Résumé: L'université de Paris I (Panthéon-Sorbonne) a ouvert en I973 la première filière française de formation à la restauration-conservation, dans plusieurs spécialités : vestiges archéologiques, collections ethnographiques, objets d'art, documents graphiques, peintures de chevalet, peintures murales, mosaïques. Cette formation, sanctionnée par un diplôme national de l'Enseignement Supérieur, dure quatre ans, associant à l'apprentissage manuel et artistique du métier (stages, travaux pratiques) un enseignement théorique très important, notamment en sciences. Elle est accessible aux bacheliers, les candidats étant retenus après entretien avec les responsables de la filière. Une sélection sévère (I sur 2 à I sur 4 suivant les années) s'opère au cours des études; la spécialisation intervient tardivement. De nombreux organismes non universitaires participent à l'enseignement (écoles d'art, laboratoires scientifiques, ateliers de restauration publics et privés). La filière est très ouverte sur l'extérieur et la réalité de la profession. Le but est de former des restaurateurs perfectibles, désireux de toujours progresser et possédant les outils théoriques qui leur permettront de suivre l'évolution du métier, mais aussi préparés aux conditions souvent difficiles dans lesquelles ils auront à l'exercer.

INTRODUCTION

La maîtrise de sciences et techniques "Conservation et Restauration des Oeuvres d'Art, des Objets et des Sites archéologiques et ethnologiques" a fait l'objet d'une première habilitation du Ministère des Universités (arrêté n°05525 du 4/IO/74) pour une période de quatre ans, avec un renouvellement automatique (oct. I979-oct. I980), puis d'une nouvelle habilitation pour quatre années (oct. I980-oct. I984).

Elle suit le régime général des M.S.T. (Maîtrise de Sciences et Techniques) créées en I97I par le Ministère des Universités pour "professionnaliser" un certain nombre d'étudiants. Elle comprend d'une part un Certificat Préparatoire de deux années, qui s'effectue parallèlement au Diplôme d'Etudes Universitaires Générales (DEUG, diplôme du premier cycle des universités), puis deux années de maîtrise proprement dite. Elle se fonde nécessairement, suivant des taux fixés par décret ministériel, sur une association de la théorie (cours, conférences, travaux dirigés) et de la pratique (Travaux Pratiques, stages). Tout aussi nécessairement, elle implique un contact avec les administrations concernées (Service de Restauration des Musées, Service des fouilles, Musées de la ville de Paris, ICOM France, Ministère des Affaires Etrangères) ainsi qu'avec le secteur privé. C'est la seule filière universitaire appliquée à la restauration et à la conservation, ce qui lui assure un recrutement varié et étendu (province, étranger).

Elle se propose de former à la profession de restaurateur dans plusieurs spécialités: peintures de chevalet, peintures murales, mosaïques, vestiges archéologiques, documents graphiques, objets d'Art, objets ethnologiques. Première tentative française de ce type, elle constituait à sa création une double gageure: introduire à l'Université un métier traditionnellement artisanal, auquel seule la voie de l'apprentissage pouvait auparavant conduire; contribuer à la modernisation et à la revalorisation de ce métier en donnant aux jeunes restaurateurs les outils théoriques (physique, chimie, biologie) qui leur permettraient de comprendre et de renouveler leur pratique, de profiter des progrès constants accomplis par la recherche scientifique appliquée à la conservation et à la restauration du patrimoine culturel.

CHOIX PEDAGOGIQUES ESSENTIELS

Pour mettre en oeuvre cette conception neuve du métier et de son enseignement, il fallut élaborer un programme complet d'études dont le niveau soit d'emblée compatible avec un diplôme national de l'enseignement supérieur. On détaillera plus loin le contenu de ce programme de quatre ans, ainsi que les nombreuses collaborations extérieures à l'Université que sa réalisation nécessita. Quelques grandes options pédagogiques en guidèrent l'organisation et déterminent encore les améliorations ou ajustements qui y sont régulièrement apportés.

I) Recrutement

La toute première donnée est sans doute la définition, à partir du choix d'un mode de recrutement, du "public" auquel la formation s'adresse. Par principe, cette filière universitaire veut être, pour tous ceux que leur milieu socio-familial n'y prédispose pas , le moyen de réaliser malgré tout leur vocation, lorsque celle-ci est bien avérée. La maîtrise est donc ouverte à tous les bacheliers, jeunes ou moins jeunes, d'origine scientifique,littéraire ou technique et quelle que soit leur familiarité avec le monde de l'art ou celui de l'artisanat.Certes,les candidats,trop nombreux,ne peuvent être tous retenus,mais il n'existe ni concours, ni exclusive a priori.Les responsables de la filière s'efforcent,au cours d'une longue série d'entretiens, de retenir les élèves les plus sérieusement motivés, les plus ouverts à l'aspect pluridisciplinaire de la formation,les plus susceptibles d'en tirer profit.La sélection s'opère ensuite,au cours des deux premières d'études,sur la base des aptitudes,autant manuelles qu'intellectuelles,et de la capacité de travail qui se révèlent.Ce mode de recrutement entraîne,on l'imagine,une grande disparité d'expériences,d'âges,etc... chez les élèves,disparité sur laquelle nous reviendrons.On peut en résumer le principe ainsi: recruter non sur la base d'une connaissance du métier déjà acquise,mais sur celle du désir de l'apprendre et de l'ouverture d'esprit.Les études doivent donc satisfaire le premier et,si possible,entretenir la seconde.

II)Spécialisation

Ceci posé,l'option pour une spécialisation tardive des élèves dans tel ou tel domaine de la restauration semble couler de source.Les deux années de formation générale commune qui leur sont imposées permettent en effet,outre l'éducation de la main et du sens artistique,la formation en sciences et en histoire de l'art,la découverte concrète de matériaux et de problèmes techniques très variés: l'élève oriente ainsi sa spécialisation à l'aide de cet apprentissage diversifié et se dirige sur le domaine le mieux adapté à sa personnalité et à ses aptitudes.Cette large formation générale contribue aussi à diversifier les débouchés et à élargir les compétences:une collection muséale hétéroclite,un objet composite,une peinture sur support insolite ne placent pas devant l'obstacle du "jamais vu".Enfin le refus d'une spécialisation étroite et trop précoce fait émerger la Restauration comme discipline globale,avec une méthodologie,une éthique, des exigences déontologiques propres.Ce dernier point est extrêmement important: les jeunes diplômés une fois installés gardent le sentiment d'appartenir à une même communauté professionnelle,animée de débats,de difficultés,de progrès qui peuvent être largement partagés.

III)Formation scientifique

Dans ce bagage commun à tous les élèves,la formation scientifique,et en particulier l'acquisition d'un bon niveau en chimie,occupe une place fondamentale.Il s'agit en premier lieu de donner aux futurs restaurateurs les moyens de comprendre leur pratique: la nature des matériaux anciens,le processus de leur vieillissement,les mécanismes mis en cause dans les traitements qu'ils effectuent,le comportement des matériaux modernes,notamment synthétiques,qu'ils utilisent,etc... ; ceci non seulement pour l'immédiat bénéfice qu'ils en tirent,mais aussi pour leur permettre dans l'avenir d'évoluer avec le métier,de suivre les progrès accomplis dans tel ou tel secteur de la recherche,de dialoguer avec les scientifiques et de comprendre leurs publications.

Ce qui est attendu aussi de l'enseignement des sciences,c'est en quelque sorte qu'il "pondère" l'immense part sensible et subjective du travail du restaurateur,sans la réduire,mais en lui apportant un contrepoint d'exigence de rigueur,d'esprit de questionnement,et en définitive de prudence.Le but est de former des restaurateurs compétents,mais capables de sagesse en face du cas particulier de chaque oeuvre qui leur sera confiée: posant clairement les problèmes et connaissant bien leurs limites.Nous savons combien il est difficile de maîtriser toutes les données d'une restauration et à quel point l'inattendu peut toujours survenir: une solide formation scientifique développe à cet égard l'imagination,encourage la modestie et la volonté de comprendre toujours mieux et toujours plus. C'est là encore un choix pédagogique essentiel qui s'exprime.On ne forme pas en quatre ans un restaurateur expérimenté!Mais on peut tenter de former un restaurateur qui soit d'une part à l'abri des maladresses et des audaces risquées,et qui soit d'autre part hautement perfectible.

ORGANISATION DES ETUDES

I)Variété des étudiants et des enseignants

Celle des étudiants est d'abord un obstacle avant d'être une richesse.Les élèves (trente à quarante en première année,vingt à vingt cinq en deuxième,une quinzaine en maîtrise) sont d'origine très diverse (baccalauréats scientifiques,littéraires ou techniques et souvent études antérieures en faculté de sciences ou de lettres,ou encore en écoles d'art,comme les Beaux Arts ou à vocation plus technique comme l'école Estienne).Leurs motivations et leurs projets diffèrent également...Mais le fait de constituer un groupe durant au moins trois ans crée une ambiance très unie,encore que demeure la diversité des préoccupations: ainsi naît un esprit qui est fait de la synthèse de toutes ces diversités.

A côté des disciplines purement scientifiques, enseignées par la faculté des sciences Pierre et Marie Curie (Université de Paris VI),et de la culture en Histoire de l'Art et Archéologie,assurée par Paris I, de nombreux cours ont dû être créés avec le concours d'organismes et de personnes extérieures à l'Université.Les cours de dessin,de couleur et de modelage sont donnés par une Ecole de Dessin de la ville de Paris.Plusieurs musées participent à l'enseignement (Cluny,Carnavalet,Département de la restauration des peintures du Louvre)ainsi que quelques grands laboratoires scientifiques (Laboratoire de Recherche des Musées de France,Laboratoire de Recherche des Monuments Historiques,Centre de Recherche sur la Conservation des Documents Graphiques,Groupe de Recherche en chimie macromoléculaire du C.N.R.S.).Aux côtés de ces chercheurs interviennent aussi des ingénieurs(Institut Textile de France,Centre Technique du Bois).Des artisans, des restaurateurs privés agréés des Musées de France, un peintre,encadrent les élèves en travaux pratiques. Certains enseignements généraux de conservation-restauration,le droit appliqué aux oeuvres d'art sont assurés par des titulaires de l'enseignement supérieur.

Cette gamme très vaste d'enseignants permet sans aucun doute à la Maîtrise d'être une sorte de creuset et de lieu d'échanges où petit à petit,par le biais d'une réflexion commune,s'élabore une formation ample et neuve.

II)<u>Programme</u>

Pour être admis en Maîtrise proprement dite,les étudiants doivent être titulaires à la fois d'un Certificat Préparatoire et d'un diplôme d'Etudes Universitaires générales.Ce diplôme paut être préparé en Sciences Humaines ,dans la spécialité Histoire des Arts ou Archéologie,et dans ce cas le Certificat Préparatoire ne comporte pas ces disciplines.Il peut également être obtenu en Sciences (Sciences exactes ou Sciences de la nature)et les étudiants sont alors dispensés des enseignements scientifiques du Certificat Préparatoire.

<u>Certificat préparatoire,enseignements communs à tous les étudiants</u> :

-Initiation théorique générale à la conservation - restauration:méthodologie,formation documentaire et bibliographie;matériaux anciens,technologie et altérations,traitements envisageables;discussions,reflexion critique.(2 heures par semaine chaque année).

-Dessin:initiation au dessin,à la peinture,théorie des couleurs (6 heures par semaine chaque année).

-Travaux pratiques :restauration de céramiques modernes, travail du bois,dorure,stucage en première année;en deuxième année,restauration de céramiques et de verres anciens,restauration de peintures de chevalet,moulages (une journée par semaine chaque année).

<u>Pour les étudiants scientifiques</u>,initiation à l'Histoire de l'Art sous la forme de deux cours méthodologiques et de l'étude de quatre productions artistiques particulières appartenant aux quatre périodes: antique médiéval,moderne,contemporain.(6h.hebdo.chaque année).

<u>Pour les étudiants littéraires</u>,formation scientifique:

Chimie générale en première année (structure de l'atome,liaisons chimiques,cinétique chimique,thermodynamique);Chimie minérale et organique,par semestre, en deuxième année.
Mathématiques,en première et deuxième année (Analyse ; Statistiques et Probabilités).
Physique en deuxième année (dynamique du point matériel,dynamique et statique des solides,calorimétrie et changements d'état,électricité,ondes,optique,physique nucléaire.).
Ces enseignements scientifiques occupent 6 à 8 heures hebdomadaires chaque année.

La première année de Maîtrise est une année de préspécialisation; les étudiants choisissent en effet entre deux grandes options "Peintures" ou "Objets".Un certain nombre de cours restent communs.

Première année de Maîtrise,enseignements communs à tous les étudiants:

-Conservation des Documents Graphiques:technologie des cuirs et papiers,techniques d'analyses,étude des agents de détérioration,techniques de conservation,techniques de restauration.
-Conservation des Textiles:nature des fibres végétales animales et synthétiques,technologie,propriétés comparées,agents de détérioration,techniques de conservation et de restauration.
-Régime juridique du patrimoine culturel en France:les organismes de protection du Patrimoine culturel; statut du Patrimoine culturel public (Entrée des biens dans le domaine public,régime et usage des collections publiques,exceptions à l'immutabilité); protection du Patrimoine culturel privé (limitations du droit de propriété,commerce de l'art,contrôle de ce commerce).
-Biologie: rganisation des êtres vivants,éléments de biochimie,microbiologie,cycle des éléments dans la biosphère,organisation et biologie des végétaux vasculaires,bactéries et végétaux inférieurs,biologie de quelques types d'insectes.
-Techniques scientifiques d'analyse des oeuvres d'art: exposé des méthodes (photo,microphoto,macrophoto,ultra violet,infra-rouge,radiographie X,microchimie,chromatographie,spectrométrie d'émission U.V.,spectrométrie de fluorescence X,diffraction X.),interprétation des résultats,méthodologie.
-Etude des matériaux synthétiques:généralités sur les matériaux macromoléculaires,principaux polymères thermodurcissables et thermoplastiques,propriétés technologiques comparées et applications,études de laboratoire et réalisations concrètes dans la restauration et la conservation,imprégnation à l'aide de monomères, techniques d'injection.
-Etude des matériaux constitutifs de la peinture:propriétés physiques,optiques,chimiques et photochimiques

caractérisation,mise en oeuvre,causes,processus et effets du vieillissement,qualités exigibles des liants, solvants et pigments utilisés en restauration.

Enseignements de l'option "Peintures":

-Théorie de la restauration des peintures:panorama des techniques de l'allègement,de la retouche et du traitement des supports,politique des choix à effectuer,histoire des idées en restauration.

-Histoire de la Peinture:histoire des techniques picturales,morphologie de l'oeuvre d'art,étude des sources écrites anciennes.

-Travaux pratiques:techniques picturales anciennes, copies de maîtres(huile et tempera).

-Travaux pratiques:préparation à l'ancienne des matières picturales,préparation traditionnelle des supports à peindre,dorure.

-Travaux pratiques:essais systématiques et comparatifs de différentes techniques et de matériaux contemporains utilisés en restauration (solvants,retouches, vernis,rentoilage,refixage)

Enseignements de l'option "Objets":

-Histoire des objets d'art:Approche technologique et stylistique,deux volets:les arts mineurs de l'antiquité et du Moyen-Age (émaux,orfèvrerie,ivoires),les arts décoratifs aux époques modernes et contemporaines (Objets d'art et de décoration intérieure,arts de la table,parures vestimentaires,orfèvrerie).

-Conservation et Restauration des objets :en travaux dirigés,méthodologie générale,conduite d'un traitement,politique des choix à effectuer ; en cycle de conférences ,nature physico-chimique,altérations et techniques de conservation - restauration des matériaux suivants:bois,marquetterie composite,pierre, verre,céramique,métaux,os et ivoire.

-Travaux pratiques:atelier de modelage.

-Travaux pratiques:essais systématiques et comparatifs sur trois thèmes:teintures,vernis ,colles,recettes anciennes et matériaux contemporains;corrosion et nettoyage des métaux,nettoyage et consolidation des textiles.

-Travaux pratiques:restauration de pièces anciennes, en fonction de ce qui est confié à l'atelier de la maîtrise par divers organismes ou personnes privées.

-Sciences de la terre:principes des datations géologiques,géodynamique externe,pétrographie.

Cet ensemble représente,dans chaque option,une quarantaine d'heures d'enseignement hebdomadaire.

La dernière année d'études est entièrement consacrée aux stages pratiques de spécialisation.

III)Stages

Dès le Certificat Préparatoire,un certain nombre de stages courts (et facultatifs) sont proposés aux étudiants pendant les vacances universitaires.Ils ont pour but de familiariser très tôt les élèves avec la réalité de leur future profession et s'effectuent le plus souvent sur chantiers (fouilles archéologiques, restauration de peintures murales <u>in situ</u>),dans les ateliers privés des anciens élèves installés,dans quelques centres parisiens ou provinciaux (Arts etTraditions Populaires,Carnavalet,Sèvres,Soissons...).

La quatrième année,quant à elle,consiste en un (ou deux)stage obligatoire d'une durée minimum de six mois,au terme desquels l'étudiant rédige un mémoire de Maîtrise relatant son expérience et le responsable de stage transmet un rapport confidentiel à l'université. Ces stages,souvent accompagnés de bourse,sont déterminants pour la spécialisation et l'emploi des étudiants mais aussi pour le dynamisme de la filière entière.

Nous avons toujours trouvé auprès des autorités des institutions concernées et des restaurateurs privés la compréhension la plus totale,et nos étudiants ont toujours été bien appréciés.

En France même,de nombreuses institutions ont accueilli nos étudiants:le Louvre,le Laboratoire de Recherche des Musées de France,le Laboratoire de Recherche des Monuments Historiques,le Centre de Recherche sur la Conservation des Documents Graphiques,le Centre d'Etudes Nucléaires de Grenoble,ainsique plusieurs ateliers publics provinciaux (Toulouse,Bordeaux Draguignan,Chamalières,Poitiers...) et de nombreux restaurateurs privés dont le niveau nous paraît assuré.La majeure partie des stages s'effectue cependant à l'étranger et sont pour nous le moyen d'échanges particulièrement vivifiants.L'I.R.P.A.,le Restauro, l'ICCROM,le centre de Torun en Pologne reçoivent chaque année certains de nos étudiants,mais en accueillent aussi différents musées allemands,la Fondation Abbeg,le KunstMuseum de Bâle,le Centre de restauration de Budapest,le musée des arts de Barcelone,l'Institut de pathologie du livre de Madrid,plusieurs grands ateliers de Bologne et de Florence,le British Museum et le Musée de Doncaster...Plus récemment,des stages ont pu être organisés outre-Atlantique,à Mexico,New-York, Washington,Ottawa...

En tout,plus d'une cinquantaine d'institutions ont reçu nos étudiants,et,jusqu'ici,s'en sont déclarées satisfaites.Ces séjours à l'étranger constituent pour les élèves des expériences particulièrement riches et stimulantes.Grâce aux réunions,aux discussions, aux mémoires de maîtrise qui les suivent,l'ensemble de la filière en bénéficie quelque peu,de même que la présence de nombreux étudiants étrangers en formation constitue une source permanente d'enrichissement et d'ouverture (actuellement,on compte des étudiants originaires des pays suivants:Belgique,Canada,Chili,Grande-Bretagne,Irlande,Italie,Mexique,Japon,Pologne,Pays-Bas, République Fédérale Allemande).

Ces stages,dont on voit la diversité,sont choisis en accord avec l'étudiant et s'adaptent étroitement à sa personnalité,à ses compétences,à son projet professionnel. Ils sont,dans la mesure du possible,l'occasion d'une formation approfondie dans une spécialisation de pointe,ou au contraire,d'une formation élargie à des domaines complémentaires,comme c'est nécessairement le cas,par exemple,pour les restaurateurs spécialisés en archéologie.

CONCLUSION

Quatre promotions sont sorties à ce jour de la Maîtrise de Paris I,ce qui représente environ quarante-cinq étudiants. Ceux des promotions 76/77 et 77/78 ont quasiment tous trouvé un emploi,soit dans la restauration privée(peintures,sculptures,papiers,textiles,objets d'art)soit,de façon parfois précaire,dans les musées. Certains continuent à se spécialiser pour acquérir une stabilisation de leur emploi,en accord avec leur futur employeur. Quelques-uns poursuivent des recherches (thèses de troisième cycle) directement liées à la restauration (par ex. conservation des négatifs photographiques,étude des vernis finaux utilisés en restauration de peintures). La gamme des emplois et des recherches est très ouverte: certains anciens élèves se sont spécialisés sur des questions aussi variées que la conservation des bois gorgés d'eau,le rentoilage,la restauration des charpentes traditionnelles,celle des maquettes marines,des objets archéologiques...

Deux faits paraissent importants à souligner. Le premier est que les anciens étudiants continuent à se voir et à échanger informations et expériences et qu'ils ont le souci d'entrer en contact avec leurs cadets. Le second est que,malgré l'opposition tranchée,et bien française,entre intellectuels et manuels (avec les préjugés émanant des intellectuels,mais aussi des manuels),une certaine voie nous paraît désormais possible qui associe les deux.

81/22/8

MEDIUM LEVEL COURSE FOR TEXTILE RESTORERS IN HUNGARY

Agnes Timár

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

MEDIUM LEVEL COURSE FOR TEXTILE RESTORERS IN HUNGARY

Agnes Timár

Institute of Conservation and Methodology of Museums
P.O.B. 54
1476 Budapest
(Könyves Kálmán krt. 40,
1087 Budapest)
Hungary

The exposition of the organization and subjects of the two year correspondence course for textile restorers, compiled considering the type of Hungarian museum collections and the tasks of the restorers, must be placed in the context of a short survey on the possibilities of extension training of the Hungarian object restorers.

In every country, the training of restorers is adjusted to the demands and possibilities of the country. During the compilation of the curriculum of our course two fundamental aspects have been considered:

1. Of what sorts of textiles consist the greater part of textile collections in Hungary?
2. What basic training do textile restorers have and what are the tasks awaiting them in the museums?

Except the church collections there are three great central textile collections in Hungary: one in the Hungarian National Museum (Magyar Nemzeti Muzeum), one in the Museums of Decorative Arts (Iparmüvészeti Muzeum) and one in the Museum of Ethnography (Néprajzi Muzeum). The Budapest History Museum (Budapesti Történeti Muzeum) stores somewhat less textiles. From these only the collection of the Museum of Ethnography consists of textiles of the same type, in other museums (about 25 collections in Budapest, about 82 collections in the country) the collections contain textiles representing the folk art of the region, archaeological finds, secular and canonical costumes, flags, tapestries, embroideries and other different types of textile finds. Some museums also collect modern textile works of art. The diversity of the collections makes the specialization of textile restorers impossible.

The number of different tasks in most museums is also an argument against specialization of the highest degree; besides restoration and conservation restorers also are responsible for the collection, help during excavations and in exhibition designing and building. In most cases they can't restrict themselves to the care of textiles, and have to do at least basic conservation of leather and wood finds, too. In little museums textile restorers must participate in the processing of the whole material of an excavation, and during the preparation of an exhibition in the restoration of metal and ceramic objects.

In our museums "assistant restorers" must be high-school graduates. After one year of practice the direction of the museum has to enable them to participate at the basic restorer's course, organized by the ICMM. Only candidates having passed the entrance examination - biology and chemistry learnt in high school - are accepted. During the one month of the basic course the students have about 8 lessons daily dealing with the basic notions of restoration.

There are two possibilities for extension training. After five years of practice a four year correspondence course for object restorers, organized jointly by the College of Fine Arts and the ICMM can be attended. The other possibility is to follow a two year medium level specialized course, organized by the ICMM. Courses specialized in the conservation and restoration of metal, wooden, silicate and textile objects are held. The choice is naturally motivated by the interests of the museum employing the restorer in question.

The first medium level course on the conservation and restoration of textiles began in January 1980, the second in January 1981. Both courses have 15 students. Beside the collaborators of the ICMM all well-known textile restorers of Hungary participate in the preparation and running of the courses, either as lecturers, or as sponsors of diploma pieces and members of the committee judging the diploma pieces. It happens that during a meeting in connection with the training other subjects of interest to all of us are discussed or that outsiders receive invitations for a lecture held during the training. One of these valuable lectures - with projection of slides - was held by Pat Reeves, textile restorer of the Los Angeles County Museum of Art, another was a whole -day series of lectures on the conservation and restoration of archaeological materials. During examinations questions on the latter were included.

The two year course is subdivided into four terms. During the first two terms the students participate monthly at three-day consultations. During the third term they spend each month a week in our institute or in other textile restorer's workshops. During the fourth term a diploma piece has to be prepared. After having defended this the student receives a diploma.

Curriculum of the two year specialized course on the conservation and restoration of textiles

1. term

1. <u>General and inorganic chemistry</u>

Lecturer: Ms Párdányi
Classes: 9 theory, 9 exercises
Laws of chemical composition; theory of atoms and molecules; structure of matter; chemical systematics; systematization of inorganic compounds; solutions; types of chemical transformations; exercises; preparation of solutions; preparative laboratory exercises.

2. <u>Organic chemistry and chemistry of plastics</u>

Lecturer: Ms Török
Classes: 16
Basic notions of organic chemistry; organic compounds; nomenclature; solvents; surface active agenses; organic disinfectants; dyes; basic notions of the chemistry of plastics; plastics, resins and synthetic fibres used in the conservation of textiles.

3. Chemistry of textiles

Lecturer: Ms Boross
Classes: 10 theory, 4 exercises
Physical and chemical characteristics of natural fibres; origin and types of vegetable, cellulose-based fibres, their microscopic, physical and chemical characteristics; chemistry of cellulose, microscopic, physical and chemical characteristics of animal, proteine-based fibres. Chemistry of wool and silk. The theoretical training is completed by microscopic and chemical identification of fibres.

4. Technology of textiles

Lecturers: Mr Réti, Ms Nagy, Ms Martinkó, Ms Timár, Mr Domonkos, Ms Hegedüs
Classes: 15 theory, 2, 5 days visit to factories
History and development of spinning, weaving, knitting and looping, bleaching, dyeing, printing and finishing; basic notions of technology; conclusion from the technique to the age; chemical agent and auxiliary materials used in different ages during production and decoration of textiles, which can be found on the object needing restoration; The lectures are completed by visits to factories.

5. Textile art

Lecturer: Ms Tompos, Ms Gombos
Classes: 12
Not-woven textiles; woven fabrics; hosiery; tapestries; gobelins; rugs. Lectures are held in the rooms of the Museum of Decorative Arts and illustrated by original objects and slides.

6. Techniques

Lecturer: Ms Nagy
Classes: 14
Weaving weave tapestry bobbin; tapestry weaving; woven (kelim) rug; burled rug. The students make a copy of a part of an original art object.

7. Labour safety

Lecturer: Mr Morgós
Classes: 2
General rules of work safety and fire protection.

Examinations:

- general, inorganic, organic chemistry; chemistry of plastics
- textile chemistry
- textile technology

2. term

1. Textile art (continued)

Lecturer: Ms Tompos, Ms Fél, Ms Dózsa
Classes: 20
Embroidered textiles; lace; secular and canonical costumes; accessories of costumes; ethnographic textiles.

2. Care of textiles

Lecturers: Mr Pécsi, Ms Párdányi, Ms Dalnoki, Ms Nagy, Ms Gombos
Classes: 22
Influence of climate and light on textiles; biological parasites and their control; storage and exhibition of textiles; find rescue during excavations and in cripts; development and furnishings of textile restorer workshops.

3. Techniques

Lecturer: Ms Nagy
Classes: 20
Embroidery, bead-work, woven bead-decorations; threading of beads; sewing; patching, mending. Practising of stitches used in restoration.

4. Special literature, library

Lecturer: Ms Muzslai
Classes: 4
Information on the library of the ICMM; catalogues and punched cards; (abstracting) journals; methodology of making literature lists.

5. Documentation

Lecturer: Ms Nagy
Classes: 2
Detailed documentation of textile restoration, making of microscopic and other photos.

6. Publications

Lecturer: Mr Éri
Classes: 2
Preparation of studies, articles, notes and lists of literature, advice on the use of literature.

Examination:

- textile art
- care of textiles

Practice mark: - techniques

3. term

1. Conservation and restoration of textiles in theory and practice

Lecturers: Ms Nagy, Ms Timár, Ms Laki, Ms Boross, Ms Járó, Ms Dalnoki, Ms Tésik, Ms Gombos

a/ operations before cleaning
- description of the state of the textile
- identification of soiling
- test of colour-fastness of the dyes

Classes: 8

b/ Cleaning
- vacuum cleaning
- wet cleaning
- dry cleaning
- combination of wet and dry cleaning
- removal of opots
- bleaching
- role of pH
- softening

Classes: 18

c/ care of textiles with metallized yarns
- history of the use of mẹtallized yarns
- analytical identification of metallized yarns and metal parts

Cleaning and conservation of metallized yarns and removable metal parts of textiles

Classes: 8

d/ Cleaning and conservation of textile combined with leather

Classes: 3

e/ soil science

Classes: 2

f/ Cleaning, conservation and restoration of archaeological textiles

Classes: a whole day symposium with projection of slides

g/ restoration of woven, knit, embroidered fabrics, laces, tapestries, gobelins, woven (kelim) and burled rugs

Classes: 45

h/ methods of restoring flags, doublong

Classes: 18

i/ restoration of costumes, making of patterns

Classes: 45

j/ dyeing of completing textiles and embroidery threads

Classes: 18

2. Theory and practice of the analysis of textiles

During the last week of practice of the term the students carry out material analysis on their own diploma piece, but they inform each other on the processes and results.

a/ microscopic and chemical identification of threads
b/ tenuity and characteristic twist of threads
c/ density of cloth, weft and warp density

d/ identification of weave
e/ identification of dyes and materials used during printing and finishing
f/ conclusion about the history of techniques
Classes: 45

4. term

During this term the students restore and document a diploma piece, belonging to the museum employing them. The work is done with the guidance of the sponsor, but at their own workplace.
Each sponsor has two students; the latter may ask any time for the sponsor's help or advice. The sponsor recommends literature, controls the progress of the work and provides for adequate circumstances for taking photos. The sponsors are: Ms Nagy, Ms Laki, Ms Gombos, Ms Perjés, Ms Sipos, Ms Mozer. The diploma piece is accepted by a committee; the student has to answer questions of the committee concerning the work; having done this they receive a diploma. The diploma pieces are displayed for a short time in a museum.

As you see from the curriculum and the number of classes, the students acquire the basic knowledge necessary for the conservation and restoration of textiles during periodical consultations, without suspending their everyday work. In this short time we are not able to form very highly specialized restorers; and anyway, our most important aim is to enlarge in the museums the number of those, who having the adequate basic knowledge and information, touch the textile objects with trained hands, and in a complicated case are able to make use of the special literature and find the help of highly qualified specialists.

81/22/9

THE RESTORER'S PROFESSION, ITS DEVELOPMENTAL LEVEL AND THE SELECTION OF GIFTED APPLICANTS

Ingo Sandner

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

THE RESTORER'S PROFESSION, ITS DEVELOPMENTAL LEVEL AND THE SELECTION OF GIFTED APPLICANTS

Ingo Sandner

Hochschüle für Bildende Künste Dresden
Güntzstrasze 34
8019 Dresden
GDR

ABSTRACT

The much greater theoretical demands imposed on restorers, the essential collaboration with art historians and scientists have increasingly resulted in a clear-cut professional pattern distinct from other professions. Today, there is the danger of too heavy a scientific load on the restorer's work. In most countries, the work of a restorer has become academic in nature.

The nucleus of each training of restorers has been practical conservation and restoration work on the object concerned. Also, the continued collaboration or partnership between restorer, art historian and natural scientist is prerequisite to right decisions as to the execution of restoration work and to the advancement of working methods.

Tests on the recognition of an applicant's aptitude for a restorer's profession are under discussion. At most educational establishments a more-than-one-day artistic aptitude test is conducted, specifically on future picture restorers. Proper examination tasks and admission talks or course work on the arts and natural sciences permit the applicant's full personality and his/her specific aptitude to be put on test.

The professional pattern of a restorer has continued to be under discussion. Even the professional requirements a specialist has to satisfy for the preservation of art treasures have remained a subject of debate.

The major role the sciences of art and nature play in the preservation of art treasures today has changed the earlier status of a restorer - the more or less gifted craftsman. The distinction of the restorer's profession from the sciences of art and nature has become a problem.

Nowadays, there is an international trend toward imbuing the restorer's work with too much science, primarily in conjunction with academic education. Masterly documentation and exemplary diagnostic work on the object concerned often displace the restorative performance proper and make it, perhaps, secondary. The high theoretical level of a restorer of today, which has to be expected from each one in the interest of the objects being restored, may not lead to the artistic talent and skill being partially sacrificed.

The nucleus of each training of restorers has been practical conservation and restoration work on the object concerned in conjunction with the continual advancement of artistic skills. The latter applies first and foremost to restorers for paintings, sculptures and wall paintings. The restorer's dexterity, his/her sense of the response of the material, of which the object is made, to his job the intuition and sensibility in retouching and complementing cannot be supplanted by theoretical training but have to be acquired during work on the object. Any excellent documentation is worthless if the object d'art has suffered damage rather than benefit by insensitive hand.

I do not want to support those who think year-long skill to be sufficient in order to be a good restorer. On the contrary, a restorer who is not able to upgrade his theoretical knowledge of the arts and natural sciences so far that he may be at least a partner for scientists dealing with the care for, and preservation of, art treasures, will necessarily resign himself to a standby restorer with a very limited scope of action. Without continued collaboration or even partnership between restorers, art historians and scientists proper decisions on restoration work are unthinkable. So is the further development of working methods and essentials for the preservation of monuments in order to make necessary decisions. The separation of brain work from manual work, i.e. the restorer's classification as a craftsman supervised and guided by a scientist ought to be a matter of the past. This is, however, only possible if the restorer's level of qualification will be raised, and a sufficient number of scientists are willing to specialize in this collaboration with the restorers. The former should become partners as well. They are often too little acquainted with the working methods applied at restorer's workshops.

The demands that are currently placed on a restorer conform to those of other academic professions or at least to a medium-level education.

The forthcoming tasks can no longer be tackled without any systematic training of future restorers and without a teaching program consistently oriented to the requirements in the field. Only this way can the restorer's profession achieve the social status it deserves.

For years there have been talks about the required degree of specialization, above all in connection with the establishment of teaching programs. The breakdown into many restoration fields is making progress throughout the world. The foundation of larger workshops as well as the further specialization of museums call for restorers who, in addition to a general survey, will have to cope with specific fields of restoration work so that they become an indispensable partner for numerous museum problems to solve. Even the work done at the workshops for the preservation of historic monuments is now much more specialized than it was some years ago. Procedures and methods require so much technical knowledge that an all-round restorer is necessarily doomed to mediocrity only. Here lies the contradiction that needs to be settled, for too high a specialization will narrow the field of vision. It will be a good sense of the right proportion between the degree of generality and the need for specialization that leads to efficient training programs.

Selecting gifted applicants

The question as to what the most important criteria for aptitude are an applicant has to meet at a restorer's training center is often asked. The individual subjects require, of course, different basic knowledge. Therefore, aptitude tests to single out the most capable applicants have to be conducted for each discipline differently. The following abilities are regarded as prerequisite in any case:

- Artistic intuition
- Manual skill, coupled with scientific precision and endurance
- Propensity and ability to scientifically-founded work

In the following an attempt will be made at suggesting some possibilities of aptitude tests for picture restorers. Greater demands are usually imposed on the artistic ability of future picture restorers than are on some other fields of restoration work. An academic picture restorer is expected to make copies and reconstruct missing picture sections if required. One of the most essential preconditions that an applicant has to prove in this field is excellent artistic skill. To be able to judge the applicant, one has to set examination tasks and fix guidelines for assessment which permit a "measurable" comparison to be made.

The artistic aptitude test

There are training centers that deem sufficient an assessment of the artistic talent and skill in view of a submitted file with the applicant's own artistic work. Most of the restorer's schools, above all those which are affiliated to art academies, conduct aptitude tests lasting from three days up to three weeks. Irrespective of the length of the examination time deemed necessary, I consider the following examination tasks to be suitable and measurable within a comparison:

- Drawing after a model (figure, portrait) and a still life (examination of observation power, proportionality rendering, and of the spatial coverage of nature)
  It cannot and may not be the goal of a restorer's aptitude test to try his / her artistic imagination.
- Painting in nature in connection with a colour test (examination of colour perception and the ability to perceive and reproduce colours)
  High sensitivity to finest shades and colour gradation is a must for the picture restorer.

- Copying
  (examination of the ability to close observation and reproduction)
  Especially suitable for copying are graphic patterns. The crayon compels the applicant to precise reproduction and coverage of lines.

The artistic aptitude test should be conducted so that manual skill and the tendency to scientific precision and endurance are made evident.

Parallel to this test, admission talks, coupled with the examination of the knowledge of the arts and natural sciences, should be held. What is suitable is written work to be done according to a given subject of some measure of generality. The applicant should give the reason for his/her decision to become a restorer and voice his/her opinion of the fosterage and preservation of the cultural heritage. The applicant's educational level in history of art and chemistry should be tested by clear-cut questions.

What seems to me particularly essential is the personal contact of the examination board to the applicant. Repeated talks will make the full personality much more evident. In view of the large number of applicants awaiting admission to studies in restoration at the respective establishments, it is possible to single out the most gifted and sedulous applicants after their artistic aptitude has been evidenced. Emphasis should also be laid on efficiency reports, expert opinions and judgments from schools, workshops or specialists as well as on certificates whenever a decision is made.

Applicants without any 12-year school attendance or graduation from a technical school (medium-level engineer) are not admitted to studies in restoration.

What has proved to be successful is the preparation of apt applicants for studies during a one- to two-year preliminary course at a larger restorers' workshop. Such an aptitude test in the field has lessened the number of those who have a low performance or even fail during their studies. A continued contact between academy and the place of work may also have an effect on the preparation of the future student. The Dresden Academy of Fine Arts does not admit any applicant to studies in restoration who was not active at a restorers' workshop for at least one year.

81/22/10

CONSERVATION TRAINING IN THE MASTER OF ART CONSERVATION PROGRAMME, QUEEN'S UNIVERSITY, KINGSTON, CANADA

Barbara A. Ramsay

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

CONSERVATION TRAINING IN THE MASTER OF ART CONSERVATION PROGRAMME, QUEEN'S UNIVERSITY, KINGSTON, CANADA

Barbara A. Ramsay

Conservator of Fine Art
Restoration and Conservation Laboratory
National Gallery of Canada
Ottawa, Ontario K1A OM8
Canada

ABSTRACT

A graduate of the Queen's University Master of Art Conservation Programme, Kingston, Canada, discusses her training in a North American university situation. A description of the programme, its requirements, stress placed on theoretical knowledge and practical experience, and how it prepared the trainee for work in the conservation profession, are evaluated from personal experience.

I. Introduction

When requested by the Coordinator of this Working Group to give an account of my conservation training in a North American situation, I hesitated due to the foreseen difficulty in remaining, or appearing, truly objective in my evaluation. I agreed to prepare this paper, however, after much consideration of the work experience which I have acquired in the conservation profession since my graduation five years ago, and having viewed this experience in terms of how my formal training had prepared me for it. To this end, I hereby present a personal evaluation of conservation training in the Queen's University Master of Art Conservation Programme, Kingston, Canada. I will be discussing my experience as one of the first five graduate students accepted into the Fine Art section when the course commenced in 1974.

II. Description of the Master of Art Conservation (M.A.C.) Programme

1. Organizational Structure

The Art Conservation Programme offered by Queen's University, Kingston, Ontario, Canada, is a two-year programme, the successful completion of which results in a Master's Degree (M.A.C.). The course is divided into three programmes of specialization: Fine Art, Artifacts and Research, of which one must be selected by the student upon application for admission. Each year, five students are accepted into the Fine Art stream, six into the Artifacts section and one or two into Research.

2. Requirements for Admission into the Programme

Pre-requisites for admission into the M.A.C. Programme in 1974 included a post-secondary, Bachelor's Degree in either science or arts, with a minimum requirement of courses in the alternate discipline. The aim was, as I understand it, to select individuals having a certain knowledge of art history and having demonstrated artistic sensibility and expression, as well as having the ability to comprehend scientific principles and approach problems in a logical or scientific manner.

My background consisted of a Bachelor of Science Degree in Biology, which had included courses in Chemistry and Anthropology. Having always had an avid interest in fine art, I then devoted myself to the study of art history and undertook studio artwork for one year. To help make up my deficiency in formal art historical study, I took classes in art history at Queen's University during my first year in the conservation programme. Students who had studied art for their first degree were required to take an option course in biology or chemistry.

3. Environment

The M.A.C. Programme was fortunate in being housed in a building annexe to a small art gallery within the university setting. The physical connection with an art gallery, as well as inclusion of the Master's Programme in the Department of Art of Queen's University, provided an aesthetically and art historically stimulating environment with *in situ* exposure to the concerns of a small art gallery.

The university environment also provided the benefits of collaboration with the departments of metallurgical engineering, biology, chemistry and physics, where interested specialists were willing to offer their time, expertise and instrumentation to the projects and concerns of the conservation programme. This affiliation provided the M.A.C. Programme with much desired consultation as well as analytical services in return for interesting and different areas of study for these scientists. This arrangement acted to reinforce the importance of collaboration between conservators and specialists from other disciplines.

4. Facilities, Equipment and Staff

The new facilities of the M.A.C. Programme were specially designed and built for the training of conservation students and the active treatment of works of art and artifacts. Included in the planning were ample studio work spaces with generous quantities of natural daylight, ventilation and exhaust installations, specialized equipment for examination and treatment, a workshop, a small scientific laboratory, a photographic studio and darkroom, a seminar room, offices and a large freight elevator. A variety of types of equipment and abundant supplies of materials made exposure to many techniques possible.

The programme employed three full-time staff members: one Director and Professor of Fine Art Conservation; one Professor of Artifact Technology and Conservation; and one Professor of Conservation Science. Guest lecturers were brought in periodically to speak on their own specializations in conservation or related fields. At the time of my studies, there were no assistant conservators or technicians employed in the conservation studios. However, since that time, graduates of the Programme have worked as assistants in the Fine Art laboratory.

5. Required Courses and Practical Studio Work

Throughout the two-year period, lectures were given in the mornings and each afternoon was devoted to practical studio work and demonstrations. Two summer internships, each of three months duration, were required as an important part of the overall practical experience.

(i) Academic Course Work

The course work provided the trainee with a great bank of knowledge concerning materials, their properties including deterioration, as well as conservation techniques which have been used historically through to the present.

Scientific principles having to do with materials and processes were taught along with microscope and instrumental analyses. The importance of turning to the published literature for information was demonstrated. We were introduced to the available sources of conservation literature, periodicals, journals, and so on, from which we could extract relevant information, for assistance with conservation problems or projects. The quickly-growing library of resource materials at Queen's was supplemented by the Inter-Library Loan system which made available publications from almost anywhere in the world, given a waiting period of several weeks to months.

Course requirements included the researching and writing of essays on technology-and conservation-related topics, the preparation and presentation of seminars, the designing and equipping of a conservation studio for a small art gallery/museum, an oral comprehensive examination with external examiners from the conservation profession, and written examinations on lecture, demonstration and reading material. Each student was required to plan and undertake a Research Project in which some concept, material or technique employed in conservation was researched according to the scientific method, under the supervision of the Conservation Scientist. (My project involved an investigation into the surface-cleaning of paintings.)

An attitude was nurtured in the trainees toward our work in conservation as an ongoing learning experience. The importance of keeping informed of new developments in the field, such as the testing, introduction and/or abandonment of materials, was thoroughly ingrained in each one of us. This included not only updating our conservation literature, but also ongoing collaboration with other specialists. Attendance at professional conferences was seen to enable the establishment of contacts, as well as the exchange of information. The Queen's students participated annually in a Student Conference where Conservation Training Programmes in the United States and Canada got together for the presentation of both professional and student papers. Membership in conservation and museum organizations was encouraged, not only to keep in touch with others in the conservation profession, but also to prov opportunities to deal with other museum personnel. Education of memb of the public and the staff of small museums in the area of preservat of collections, became assumed as one of our responsibilities as conservators.

(ii) Conservation Practice

As was mentioned earlier, studio work was undertaken during the after- noons, and at the time of my training at Queen's, this amounted to a minimum requirement of sixteen supervised hours per week. The uppe limit of practical studio time was at the discretion of the indivi student who had unlimited access to the laboratories in the evenings and on weekends. (I found myself working in the studio at least twenty-four to thirty hours per week.) Over the course of the two years, the student was given the responsibility for several real work of art - to examine and document, to propose and carry out treatments Objects were worked upon on an individual basis, under the supervisio of the Fine Art Conservator. The importance of examining the object carefully, learning what to look for and how to interpret what was seen, was instilled in the student. Examination of the objects and reasoning out of the problems, as well as justifying of proposed solutions, was left to the student initially, in an attempt to encour independent work habits. The supervising conservator would be availa however, when consultation or advice was sought, or when guidance was deemed necessary. A critical attitude toward one's real capabilities and limitations was instilled.

Conservation treatments were carried out from beginning to completion by the same student, in the interest of enhancing the student's feeli of responsibility for the work of art, establishing a logical sequenc in the student's thought processes, and exposing the trainee to as ma different conservation techniques as possible. In addition to the development of manual skills and the manipulation of materials, an important facet of training in the Queen's Programme was the devel ment of a sensitive, yet logical, approach to the problems presented.

Documentation was emphasized as an integral part of the conservation process. Written reports plus photographic records became part of th routine procedure for each object. The information gained from suppl mentary examination techniques such as radiography, ultraviolet, infr red photography, or instrumental and microscopic analysis, was incorp ated into the dossier on each work. Condition reports and treatment proposals were prepared after carrying out a thorough examination, an conservation and restoration treatment reports followed for each obje As most of the works treated by the students had come from private collections or small museums, final reports included a special sectio entitled "Recommendations to the Owner", to advise on safe handling, storage and display of the work. This was aimed at educating the collector about preservation measures in an attempt to help ensure conservation of the work after it had left the conservation studio.

The Conservation Programme was in a special situation in that objects to be treated by the trainees could be, and were, selected on the basis of their value in providing a variety of conservation problems, so that the maximum amount of experience could be gained from each project. In this way, exposure to a greater diversity of approaches, techniques or materials was possible. The provision, by private collectors, small museums and corporations, of all manner of works of art for treatment in the conservation programme, ensured valuable experience for the trainee.

The amount of practical experience acquired during the two school years of the M.A.C. Programme, could provide the student with only a small range of the many treatments or procedures involved in the conservation of fine art. However, experience gained was broader than in many working situations in that, in addition to the projects undertaken by the individual, exposure to the projects of nine other students in the studio was a built-in requirement. Hence, the student was able to observe, and sometimes participate in, the decision-making processes or actual treatments carried out by the other students.

To supplement this still limited amount of practical experience, internships were arranged for three months of each year of the programme. In these summer internships, the trainee was required to work full-time in a recognized conservation laboratory in Canada or abroad, under the supervision of a qualified conservator. These internships provided the opportunity to work with different conservators and to be exposed to other approaches and attitudes toward conservation. Various types of objects with other kinds of problems, acted to reinforce and enrich the already-acquired theoretical knowledge and practical experience. The internships often added the dimension of strict deadlines and increased productivity which had not been overly-stressed at the beginning of the student's practical experience. At the end of each internship, the trainee was required to submit a written report on the work undertaken; the supervising conservator also provided an evaluation of the student's skills and performance. In general, these internships provided valuable experience for the Queen's students, and made up an important part of the M.A.C. training.

III. Evaluation of the M.A.C. Programme

Looking back upon the years spent in training in the M.A.C. Programme, and viewing it in terms of the work experience which I have acquired since my graduation, I can see definite aspects of the approach adopted by the staff at Queen's and the attitudes instilled there, which have prepared me to deal with situations that have arisen in conservation practice.

1. General Approach and Attitudes

Perhaps the most basic influence which the M.A.C. Programme has had upon my work as a conservator, involves ethical attitudes and professional standards which have become "second nature" and a part of my every dealing with works of art. The manner of regarding every art object or artifact with respect - for its materials, its purpose, the intent of its creator - accompanies every intervention which takes place. The approach which the student was encouraged to take in the treatment of any work of art, was that of regarding each object as being unique, to sensitively observe its properties, carefully test any materials or techniques to be employed in an intervention, and to assess the proposed treatment in terms of the implications for that particular object. One was to draw, of course, from previous experie and the treatments employed by other conservators for similar objects, but always being careful not to generalize common treatments to a situation where special precautions or modifications of method might be preferable.

Specialization was encouraged to a certain extent in that one had to choose, upon entering the M.A.C. Programme, the Fine Art, Artifacts or Research stream. For the Fine Art trainee, this meant a genera teaching in the materials, properties and theory of conservation of fine art objects and artifacts, but required practical work on only paintings and works of art on paper, with minor exceptions. After having gained experience with materials in both of these areas, the student could then further specialize if desired. The internships afforded the opportunity to select an area particularly appealing to the interests and abilities of the trainee. This structure prepared the student for employment in most conservation situations in Canada and elsewhere.

Generalization of theoretical knowledge was, however, very much requi in the M.A.C. Programme. The multidisciplinary approach adopted by t teaching staff educated the trainee in the properties and conservatio problems of a wide range of materials. Studying the technology and conservation theory of organic and inorganic artifacts, in addition t that of paintings and works of art on paper, provided a greater bank knowledge to draw from. The student was given a familiarity with and understanding of methods generally used for objects, but which could oftentimes be applied to the conservation of paintings or sculpture. It was demonstrated that there was often an overlap in materials and techniques used traditionally in other specializations, and that this collaboration was not always taken advantage of.

One of the most stimulating aspects of the environment of the Queen Programme was the bringing together of individuals from different backgrounds to a common setting with common goals. Students in the Programme during my years at Queen's, had come from undergraduate and graduate studies in art history, studio art, chemistry, biology, arch aeology, anthropology and museology. The variety in attitudes, exper iences and thus approaches brought into the conservation programme, made the learning process even richer and more rewarding. The opportunity of working in the studio, on personal conservation projects wh in close proximity to nine others working on related and dissimilar treatments, provided a wealth of exposure to different materials, techniques and applications. Not only was there exposure to the cons vation work being done by other Fine Art students, but also the adjac ency of the Artifacts studio enabled a close interaction between the students in both streams.

Another aspect of the multidisciplinary approach taken at Queen's, was the emphasis placed upon collaboration amongst conservators, art historians, artists, curators, architects and scientists. Active communication and exchange between these specialists, as a complement to the aesthetic and artistic sensibilities of the conservator, provides, I believe, a well-rounded forum which takes into consideration the many aspects of a work of art.

The training programme at Queen's University placed a great deal of emphasis on the technology and properties of materials. A strong grounding in these areas made an understanding of deterioration processes and conservation practices more logical. The trainee was then prepared to analyze each situation separately in terms of the individual conditions presented and the properties of the materials involved. I found that I was provided with the background enabling me to reason out the reactions of materials in given situations.

2. "Academic Versus Practical"

A commonly-voiced criticism of formal, or university-based conservation programmes, including the Queen's M.A.C. Programme, is concerning the limited amount of practical experience provided. Comments such as "too much theory and not enough practice" have been universally expressed.

The amount of time spent in studio work made up a large proportion of the total hours of training at Queen's. Of course, the importance of maximizing the practical experience was fully realized, taking into account the necessity of theoretical training. Stress placed upon the academic and theoretical aspects of conservation should, in my opinion, not be downplayed or at all reduced. This is particularly convincing when one considers that a formal conservation programme will provide the opportunity to devote oneself so thoroughly to the acquisition of a great body of knowledge, in an intense manner, in a relatively short period of time. This basic information will be drawn from, added to, and modified as experience of the trainee enlarges, but will always provide a strong foundation.

The academic part of training at Queen's included the teaching of a wide range of conservation techniques, their advantages, disadvantages and implications. Practical experience or demonstrations of as many of these as possible were provided, given the restrictions of time and conditions of objects available for treatment. In my opinion, one could not realistically expect to acquire experience in every possible technique at Queen's. One could only hope to develop general attitudes, as well as the manual skills and reasoning involved in as many as possible, so that these abilities could be adapted to and expanded upon in later working situations.

A very important consideration with respect to the practical experience acquired is the fact that the Queen's Programme does not propose to produce "fully-qualified" art conservators at the end of a two-year period. It does, however, attempt to provide students with a sound, theoretical base and adequate practical experience in handling objects and materials to enter into the profession, or to solidify what experience they might have had previously. Ideally, this entry would into situations where supervision is still provided during the acquisition of further experience and development. It is fully realized by both M.A.C. staff and graduates of the programme, that there is no substitute for good practical experience, but that the training receiv at Queen's will help the conservation graduate to make the most of tha experience.

The existing situation in Canada concerning employment opportunities in conservation is that recent graduates of the M.A.C. Programme are accepted as interns or assistant conservators to work with more experienced conservators in established conservation facilities. The amount of responsibility allocated will depend upon individual cases and demonstrated ability. The most active in this area are the Canadi Conservation Institute and the Conservation Division of National Historic Parks and Sites. The ideal situation I view as follows: afte having completed the two-year programme at Queen's University, the graduate would acquire further practical conservation experience, firs in an internship, and then working in a supervised situation, graduall assuming greater responsibility and independence over several years.

3. "Aesthetic versus Scientific"

Another area which always carries with it considerable controversy is the "aesthetic versus scientific" approach. To some, these seem to be mutually exclusive.

The M.A.C. Programme trains individuals who are not "pure" scientists, but those endowed with artistic sensibility and appreciation, capable of recognizing the role science can play in the conservation field. Queen's carefully screens its students, in the hopes of admitting a range of individuals with varied backgrounds but with demonstrated skills in the domains of both art and science. During the course of the programme, emphasis was placed on understanding of principles and processes, and logical reasoning without necessarily a "cold, analytic approach" which has often been associated with science in conservation It was seen that a balance can be achieved between the craftsmanship and sensitivity required of a conservator, and the scientific manner which problems can be approached and dealt with. An appreciation w cultivated of what the scientific specialist can do to assist in the better understanding of the properties of a work of art, or the materials used in its restoration. The trainee was required to learn about the chemical and physical properties of materials, and the instr mental and microscopic analyses available to determine them. The type of information sought and the kind of questions to be directed at the scientist were found to be important for efficient and productive collaboration between conservator and scientist.

The required completion of a research project, while enabling the student of conservation to work through his/her own research according to the experimental method, also provided a greater understanding of all that was involved, and enabled a more objective evaluation of results of the experimentation and testing of others.

I found the attitude generated at Queen's University to be one that achieved a balance between the sensitivity and the aesthetics inherent and required in conservation, and the ways in which the application of science and the scientific method can assist in the continued respect for, and conservation of, works of art.

4. Preparation for the Conservation Profession

After having fulfilled the practical and academic requirements of the M.A.C. Programme, graduates have moved on to one-year internship positions or to posts as assistant conservators. Working under the supervision of experienced conservators has enabled the expansion of practical experience and development of abilities as competent conservators.

Having proceeded to an internship position myself, I gained much valuable experience during that year, and found myself able to put into practice much of what I had been taught during the programme at Queen's, to experiemnt with different treatments and materials, and to deal directly with a much greater number of works of art.

When I moved on to a position at the National Gallery of Canada as assistant conservator in 1977, I discovered that I was able to apply what I had learned in the M.A.C. Programme. I found it interesting to learn new methods, and easy to adapt the skills which I had developed at Queen's, to deal with new situations. Established practices of thorough examination and documentation were put to good use. I worked with a fair degree of independence and responsibility in my new position, but did know when to seek advice from the other conservators, who were always willing to provide assistance or consultation.

Since my training at Queen's University, I had often felt that I would like to practise conservation in Europe at some time, to "round out" my training, that is, to expose myself to potentially different attitudes, approaches, techniques, materials, schools of thought, and, of course, the wealth of works of art. This opportunity presented itself after two years at the National Gallery when I arranged to take six months leave of absence to do an internship in Switzerland. This position afforded the benefits of working under an experienced conservator on art works of various kinds. During my six months in Europe, I found that my practical training and theoretical learning at Queen's had prepared me quite adequately to fit into the existing chantiers/ateliers where I worked on wallpaintings as well as polychromed wooden and stone sculptures. There I was able to further develop my manual skills and acquire valuable experience in areas of conservation which I had been familiar with in only theoretical terms previously.

In general, in my various working situations, I have found myself well-equipped to accept the responsibilities given me, and have remained willing and eager for new ideas, knowledge and experience. At times, I have found myself to be a liaison between conservators of different specializations, thus putting to use the generalist aspects of my training. In other situations, I have been able to answer questions concerning the chemical or physical processes involved in treatments or concerning the properties of materials which make up works of art; this information has been directed at curators, as well as conservato who have experienced mainly the practical side of conservation withou having had much formal theoretical training. In all aspects of my wo as a conservator, development of a "good eye", a "good hand", scienti reasoning and patience, all of which were nurtured at Queen's, have proven to be ultimately important.

5. The Canadian Situation

It is important to mention the way in which the M.A.C. Programme has prepared its graduates for work as conservators within the Canadian situation.

In Canada, the collections of artistic and historical interest have wide range of materials and contexts. The extremes of climate and deteriorating effect on collections, have helped to make preventative conservation an important priority for the conservator in Canada. Sa handling, storage and display of works of art is encouraged in museum and art galleries across the country. The conservator in Canada must be able to not only conserve and restore works of art through treatme but also give advice concerning the physical preservation of objects through providing a safer environment for them.

To this end, the Queen's University Programme has, in my opinion, educated the trainee quite admirably. By teaching the principles of preventative conservation, requiring the researching and writing up of essays, and the preparation and presentation of seminars, the M.A. has prepared the conservation student to fulfill an educational funct as well as a practical, treatment-oriented one. The generalist appro has enabled the graduate to give useful and relevant information to concerned custodians of historical objects and works of art.

With the relatively recent development of conservation in Canada, museums across the country are just beginning to accept the fact that "in-house" conservation is the best answer to their problems of prese vation. The Queen's graduates are well-prepared to move into supervi positions for several years to gain much-needed practical experienc before eventually moving out into independent situations in other of the country.

6. "How it Might Have Been Better"

What I have dealt with previously incorporates my generally positive feelings concerning the training which I received in the Queen's University M.A.C. Programme. My following comments reflect my feelin about how the programme would have been an even more positive element in training.

Firstly, I would like to have seen the addition of a third year, designated as a full-time internship, as part of the required practic experience of the graduate students. Having the status of interns, I believe, does much to ensure "meaningful and valuable" learning experience for the trainee, and thus provides a more concentrated acquisition of practical experience. In saying this, I realize that under the present university system, a Master's Degree Programme cannot extend over more than a two-year period. One year internships, following graduation from Queen's, have been organized in the past on a limited basis, with funding coming from the National Museums Corporation and Ontario government programmes. It would be ideal if such a system could be reinstated as a requirement, to guarantee a third year of full-time practical experience. The alternative is for employers to provide paid internships such as the one which I experienced in Switzerland.

A second improvement would have been a larger staff complement. The addition of experienced conservators to work full-time in the studios with the students would have lessened the workload of the existing staff, providing a further learning experience through observation of other conservation treatments, and insuring varied and continuous consultation and assistance for the trainees.

IV. Conclusion

What I have presented, is a description of the Queen's University M.A.C. Programme, how it was structured and how I feel the emphasis had been directed during my training. My personal opinions about how it prepared me for my work as a conservator of fine art have been incorporated. Undoubtedly, since my graduation five years ago, changes have been made in the programme and different phases have been experienced. However, I feel that the basic aspects which I have discussed, have remained much the same.

81/22/11

THE SITUATION OF THE ACADEMIC EDUCATION OF OF RESTORERS IN HUNGARY

Geza Entz

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

THE SITUATION OF THE ACADEMIC EDUCATION OF RESTORERS IN HUNGARY

Geza Entz

Institute of Conservation
Academy of Fine Arts
Népszabadsag utja 69-71
Budapest VI
Hungary

The need for education of restorers presented itself rather late in Hungary. It was after the 2nd World War that the Highschool of Fine Arts, started restorer training at high level. In the beginning the students only dealt with panel paintings, since 1969 the program, directions and depth of training have increased alike. In addition to panel paintings the restoration of murals, stone - and woodsculptures, too, have been included in the curriculum. This also enables the students to acquire, besides practical training, the proper knowledge of history, history of arts, natural sciences and the techniques required by modern demands. The students work in the summer period in museums or in the field of preservation of monuments preparing so for accomplishment of their future tasks.

The entrance examination takes two weeks. At the end of the first week an expert committee decides whether the candidate may proceed to the second. When the second week has come to an end, the expert committes prepares a proposal of sequence to underlie the decisions of the summit committee upon final admittance.

The decisive part of training is the practice going on every morning in 24 lessons a week. The initial two years are entirely devoted to basic training in painting and sculpture with special regard to aspects of restoration.

Specialization takes place in the third year, For painter-restorers practice comprises in the third year acquainting themselves with the tasks in connection with frescoes and in wolving them. The fourth year is for restoring panel paintings. The sculptors deal with simpler tasks of restoration in the third, and with more difficult ones in the fourth year including both stone and wood sculptures. From the third year another specialization takes place, some students go on working with stone, the others with wood statues. In the fifth year wvery future restorer has to prepare the diploma piece. Painters may choose between a mural and a panel picture /some take both/, sculptors perform the restoration of an appointed stone or wood statue. After specialization all practical work is done on original pieces, the only exception being wall-painting, where every technique and restoration procedure is practised on copies made by the students.

Summer practice work takes a month. After the first year all students go to colony of artists, after the second and third, painter restorers make a museum copy and participate in the restoration of a mural respectively. Sculptor restorers take part at the restoration of a wood or stone sculpture.
After the fourth year every student has to work on his or her diploma piece.

The proportion of general and special parts of theoretical training is 3:2 by and large in the initial two years, 1:1 during the third and fourth years. In the fifth year there are language lessons only. The number of lessons devoted to theoretical subjects is greater for the lower and smaller for the higher classes. At the and of the fifth year the students take a state examination of museology /including the preservation of monuments and the history of restoration /and, as an appendix work to the diploma work, they write a paper on a branch of the above subject matters of state examination.

Since 1974 began the training of general restorers /restorers of objects/, too, started - for the time being in the form of correspondence courses - which deals with the objects made of wood, bone, metal, ceramic and glass, also touching upon leather, paper and textile works.

Their training takes place in cooperation with the Department of Museums in the Ministry of Cultural Affairs and the Instituto of Conservation and Methodology of Museums. The organization of the training of the general restorers is similar to that of the art restorers.

The considerable augmentaion of tasks necessitated the increase of the number of teachers and students as well as their expert organization. Before 1969 there had been one appointed prefessor. This number has increased to eleven, to say nothing of the temporary lecturers of theoretical subjects. The number of regular students is around 30-35, so is that of the correspondence department compared to the 8-10 students attending before 1969. The raise of the Highschool of Fine Arts to university rank made it possible to organize a univeristy institute of the Department for Restorer Training.
The continous augmentation of the staff is necessitated not only by the growing subject matter of instruction but also by the more and more expansive claims made by the museums and the institutions for the preservation of monuments on restorators.

The aim of the education of all kind of students is to preserve and restore the works of art at an artistic level.
The restorer must be in close cooperation with the specialists of historical and natural sciences in interest of the conservation and protection of all kind of cultural objects.

Curriculum for art restorers in Hungary

Art restorers.They deal with the conservation and restoration of paintings, frescoes, sculptures, stone, wood-carvings, graphic prints.

Conditions of application: examination of secondary school, respectively certificate of qualification.
Stone- or woodcarving journeyman qualification is also required from sculptor restorer candidates.

Subject of entrance oxamination: for painter restorers: head and nude drawing, to prepare coloured reproduction from given gothic or renaissance painting. For sculptor restorers: modelling the head of living model, drawing of architectonical ornaments, drawing of nudes, reproducing figural reliefs.
The examination takes two weeks.

The term of training: five years.

S u b j e c t s :

Practice	I-V.	General and inorganic chemistry	I.
History of art	I-IV.	Organic and synthetic chemistry	II.
Applied arts	III.	Analytics	III.
Folk art	IV.	Physics	I.
History of civilization	IV.	Painting technics	I.
Iconography	II.	Photography	II.
Museology	IV.	Material tests with wood	II-III.
Philosophy	II-III.	Mineralogy	II.
Aesthetics	IV.	Paleontology	IV.
Political economy	I.	Object presentment	II.
Architecture	II-III.	Knowledges of letters	III.
History of litterature	II.	Russian language	I-II.
Geometry	I-II.	English language	I-IV.
Anatomy	I-II.	Sport	I-II.
Restoration of paper	III.		

Practice weekly 24 hours /fornoon/
Theoretical subjects weekly 20-24 hours /afternoon/

Curriculum for general restorers in Hungary

General restorers. They do the conservation and restoration work of archaeological and ethnographical collections,pieces of applied arts and objects made of metal, wood, ceramics, glass, leather, textile and paper. Conditions of application: exemination of secondary school or specialized secondary school and employment in a museum or a museological institution minimum five years of continous employment as a restorer, completion of the restorer-conservator basic course made by the Institute of conservation and methodology of Museums.

Subjects of entrance examination: drawing, modelling chemistry and biology, curriculum of the secondary school The examination takes two weeks

Term of training: four years

Lessons: during term monthly one week of tutorial lessons with daily eight hours.

S u b j e c t s:

Practice in the museum where the student is employed.
Drawing and laboratory work four weeks in a year.

Figure drawing,painting,modelling	I-IV.
Restoration,conservation	I-IV.
Material tests and practice	I-IV.
Political economy	I.
Philosophy	II-IV.
Aesthetics	III.
General and special museology	I-II.
History of civilization	III.
History of applied arts	I-II.
General and inorganic chemistry with laboratory practice	I-II.
Organic and synthetic chemistry with laboratory practice	I-II.
Botany with practice	II-III.
Zoology with practice	II-III.
Physic	II.
Photography	II.
Prevention of accidents	I.

81/22/12

AN ALTERNATIVE, INDIVIDUALISED ROUTE TO UNIVERSITY TRAINING IN CONSERVATION AND RESTORATION: AN EXPERIMENT AND A CASE STUDY - SOME PROBLEMS AND A SOLUTION

E. Gwen Gardner

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Training of Restorers

AN ALTERNATIVE, INDIVIDUALISED ROUTE TO UNIVERSITY TRAINING IN CONSERVATION AND RESTORATION: AN EXPERIMENT AND A CASE STUDY - SOME PROBLEMS AND A SOLUTION

E. Gwen Gardner

Antioch International
Top Flat
5 Hastings Road
St. Helier, Jersey C.I.

ABSTRACT

In view of the present difficulties of young people who wish to receive professional and/or academic training in the field of art conservation, who yet, because of the shortage of university places and of museum workshop internship places in this field, or of lack of recognition of the profession as such, even of complete lack of access to the university in some countries, meet considerable obstacles, the following account of an experiment in a sustained partnership between a university (Antioch International) and a conservation centre (Centre for Conservation and Restoration of the Fribourg Art and Histroy Museum, Switzerland) is of interest. It shows a 'third way' for academic or university qualification in conservation, also and even especially suitable for older and more mature students.

First I must give a brief background, showing how the experiment developed, in a university not until very recently in the art conservation field.

Antioch College, a small liberal arts institution in Ohio U.S.A., gained national recognition in the 192o s, when its engineer - president, Arthur Morgan, introduced the co - operative or alternating work and study plan, which he had adapted from the British sandwhich courses for technical students and then applied to all his college students.

In 1957 Antioch added an international component for its undergraduates, an optional year abroad, usually with the work and study ingredients both included.

Then it increased in size over the next twenty years by creating a network of centres in both the Americas, and placing students abroad, usually in indigenuos universities, until in 1978 it became a national university, the University of Antioch, with a reputation for innovation and experimentation.

In 1975 as a preliminary to this last step, it was decided to initiate degree courses at the master's level. I was asked to design an M.A.program, international in scope, for a group or 'cluster' of older and mature students, in my own major field, that of peace studies (social change) and international relations, as I had been the Antioch International field director, based in Europe, for nearly twenty years. This group was to be a special part of the new individualised Master of Arts degree for those experienced students who could plan their own special program, with the help of the program director or a university advisor.

The design for my 'cluster' included a short colloqium in the U.S.A., for planning and study of American problems and foreign policy, and then a second short seminar, three month later, in Geneva, aided and encourages by the U.N. and Quaker House, and then followed by a long internship for each student, or series of internships, frequently in the U.N.. or UNESCO, or other specialised agency or international organisation. Reports and essays would be sent by the students, and evaluated also by the program director, myself, but the work would be done entirely within the agency, and closely supervised by them, the university and the organisation,host of the student working in close partnership for this training. This experience proved to have some relevance in conservation training.

After two years, we had seen that this model was viable and valuable, much aapreciated by the U.N. and other officials and employers.

The developement of the master's of art conservation at Antioch International.

At that time I was approached for consultation, by a student, already more mature, who was trying to enter the field of conservation, but had become increasingly frustrated by the difficulties and obstacles she had encountered on the way. She had tried several occupations, teaching languages, secretarial work at the U.N. and household design, before the opportunity to study and complete a B.A. in art history atColumbia University in New York, showed where her real talents and abilities lay. By that time she was thirty years.

During several long interviews I saw the considerable potential on this case, if only the administrative problems could be solved, which I believed they could be. So I encouraged her to apply to Antioch International for admission to the new Individualised M.A., specialising in her case in art conservation.

When I was asked to be her advisor or university staff co-ordinator, I accepted the challenge, in spite of my very slight experience in this field. Yet I knew from my visits to UNESCO, how important is the work of preserving of the worlds heritage. And I had wide contacts.

She was a student similar in many ways to the peace studies group. The special aspects of this case, which made it of great interest, included the following:

- The student was of Latin - American nationality, though with strong central European connections, as well as an American degree. She hoped to ultimatly work in South America, possibly in Peru, where the need is great and the workers few, in the field of painting conservation.
- An examination of her art portfolio showed talent and sensitivity.
- She had remarkably wide knowledge of all major European languages, which meant she could function and read English, German, Spanish, French and Italian, so in most of those countries, including North America, where conservation is most developed.
- Her training up to the point, where I was called in, had been scattered in different countries in very different typs of settings: after her B.A. in new York she had started training in conservation in a small fine arts college in Italy in a small art restoration class, but finding it to be highly theoretical, had left after one year to go to a German privat restorer, typ master craftsman, where the problem was reversed. After that she completed a summer field project working under supervision on a Roman mosaic.

At this point I got involved. In spite of the fragmented background I aggreed to recommend her, taking a risk. But her caracter, her third world origin - and perhaps destination - made seem it worthwhile.

In search for a museum workshop internship or a university place I met formidable obstacles. I spent several weeks searching the East coast - there I learnt of the tremenduoes pressure on places, and the high cost, and was advised to seek in Chicago or Detroit, I was told thst in a years time an opening might be possible. The same was true for a one year vacancy in the four U.S.Universities offering this degree. In Britain, even more discouraging, an application was rejected because of the applicants age. Together with an associate I began an endless round of phonecalls to German Museums and workshops. We were cordially received and given sound advice, but no place found. Given leads to Austria and Switzerland, we got the same frustrating replies, until we were advised to meet the conservator in charge of setting up the conservation and restoration centre for the convention of the Fribourg Provincial Museums,

H. C. von Imhoff, who had just returned from Canada from conservation work within Candian National Historic Sites and Parks. Timing was favourable. a few month later my student could finally start.

The time inbetween was wellused as she could assist at the university of Munic a course on the influence of environment on works of art, given by Dr. H. Kühn. We also found an opening in a commercial art gallery workshop, where previous experience proved valuable.

By November 1978, she was installed in the newly equipped laboratories and thus a most fruitful and interesting co-operation between the conservator and his other students, in the professional setting, the university - co-ordinator, and the student began.

<u>The planning and execution of this workshop-based academic training - and the teamwork involved.</u>

The conservator in charge at the conservation centre undertook to plan the overall professional program to graduation, provided the student would remain for at least two consecutive years (it became 3 academic years). This program included both theory and practice, the reading and the conservation projects.

First project was the preparation for the exhibit the mounting and the transportation of art foto exhibit. Then followed cleaning of plaster - casts, the conservation of a series of highly original, technically very interesting Swiss EX - VOTO paintings , painted in oil on unstretched canvas, to be consolidated, cleaned, relined, and else. Followed work on a wooden altar piece from the late gothic - early renaissance with considerable relevance to art history in Switzerland. There was carefully to be planned-how a complete documentation in fotografy should be done, - the transport to its original setting in a church some miles away, - measurements in climatology, u.o. On each project, a paper was to be written, showing research, documentation, photography, scientific investigation and actual conservation work.

The subject for the students final thesis was chosen, as the decision fell within the Fribourg Museum, to exhibit Marcello, a Fribourg paintress and sculptress of the 19. century. In a broad approach the student covered the art historical and social background, the development of 'chinoiserie' in Europe - as the paintings in question alliterated this style, the 'usual' technology of painting at that time and the applied criteria and methods for their conservation.

The thesis is submitted and presented now, together with the total program to her doctoral - style committee for evaluation and the conclusion of her graduate degree. Another conservator of the object field provided most of the supervision in the last year, as H. C. von Imhoff changed position to go to teach at the Bern Training course for basic training in conservation and restoration, He still gave guidance during the production of the thesis and evaluated it. My task was to gather evaluations, translate the work in academic credits and forward the paperwork to the Antioch registrar, while offering personal guidance, support and encouragement whenever needed. It has been an excellent example of teamwork.

Two side-experiences were valuable during this time, one, a museum group study tour to egypt, where she did documentation and photography and , two, attendance of the ICOM General Assembly, the international museum - directors and curators bieenial meeting in Mexico City, which linked her back again to Latin America.

She will noe take up a graduate assistantship in the Basle Künstmuseum with Dr. P. Cadorin for another year, before returning to South America.

<u>Diskussion of the specific advantages and drawbacks of this program</u>.

I think this route could be for all those, who are older, mature, selfstarters, well motivated, a possible way, certainly not for those beginners, who are not sure of their direction and chosen field.

The difference to other programs is that a university- student is workshop - based, throughout his studies, yet obtaining a degree.

Work and training , both in theory and practice, is planned by a conservator, not the university.

The university provides the academic skills and frmaework, translated experience into university credits, controls quality by assembling evaluations and checking them, by regular visits to the workshop and by team discussions. Advisory services are provided by the conservator and specialists, and by the university staff co-ordinator.

Final approval is given by the team, accepted by the university registrar, and a degree awarded.

Outlook

Antioch pioneered the individualised M.A. and would, I am sure, accept further candidates. It is essential so, that both the conservator and the university co-ordinator have a high degree of experience and requisite skills. There are other universities without walls or open universities now expanding in America and Great Britain, which could also make a similar design possible. Way would have to be made.

METALS

Coordinator: R.M.Organ (USA)

Members : E. Andersen (Denmark)
D. Ankner (FRG)
W.P.Bauer (Austria)
A. France-Lanord (France)
mr Hett
K. Holm (Denmark)
mr Ito
H. Jedrzejewska (Poland)
M. Kalish (USSR)
M.E.Laver (Canada)
J. Lehmann (Poland)
N.A.North (Australia)
M.W.Pascoe (UK)
C. Pearson (Australia)
J. Riederer (GDR)
E. Schweizer (Switzerland)
B.N.Tandon (India)
P.D.Weil (USA)
R. Wihr (FRG)
mr Cross

Programme 1978-1981

1. Alteration by ageing and the conservation treatment of objects made of silver (Gorine, Schweizer).
2. Consolidation of archaeological bronze (Ankner, France-Lanord).
3. Corrosion inhibitors, use and misuse (Pascoe).
4. Electrolytic and electro-chemical treatment (Andersen, Pearson, Wihr).
5. Protective coatings for cleaned metals (Pascoe).
6. Simple methods of analysis (Laver, Jedrzejewska).
7. Studies of patination on bronzes (Kalish, Riederer, Weil).
8. Corrosion and conservation of iron objects, above ground or underwater (Cross, Holm, Laver, North,Pearson, Schweizer).
9. Treatment of outdoor bronze (Kalish, Riederer, Weil).
10. Treatment of archaeological objects in the field (Hett).
11. Treatment of modern materials found ageing in collections (Lehmann).
12. Miscellanea on metals (Bauer, Ito, Tandon).

81/23/1

A STUDY OF DAGUERREOTYPE CLEANING SOLUTIONS

Marilyn Laver and Siegfried Rempel

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Metals

A STUDY OF DAGUERREOTYPE CLEANING SOLUTIONS

Marilyn E. Laver and Siegfried Rempel

Canadian Conservation Institute
National Museums of Canada
Ottawa, K1A OM8
Canada

Abstract

A study was conducted using atomic absorption spectrophotometry to evaluate the extent of removal of silver, copper, mercury and gold from daguerreotype plates during solution cleaning. The first part of the work compared the two main types of daguerreotype cleaning solutions referred to in the photographic and conservation literature: acidified thiosulfate ($(NH_4)_2S_2O_3$) and acidified thiourea ($CS(NH_2)_2$). Thiourea solutions were shown to be preferable because of their relative selectivity in removing Ag_2S tarnish with minimal damage to the base plate. A second part of the study considered the effects of varying the strength and acidity of thiourea solutions on the removal of mercury and gold. Preliminary recommendations can be made toward the optimization of thiourea/acid concentrations in the cleaning solutions.

Introduction

The daguerreotype plate consists of a copper base, either laminated or electroplated to cover at least one side completely with silver. The image on the highly polished silver surface consists of particles of a silver-mercury amalgam. Gold toning was applied optionally to the photograph as a final process. Detailed information concerning the physical structure of daguerreotypes has been determined by scanning electron microscopy (1).

The degradation of the photograph is primarily due to the formation of a tarnish film of Ag_2S on the surface, which obscures the image. The purpose of our experiments was to evaluate the damage done to the photograph during solution cleaning. Solutions used in the cleaning process were monitored for Ag, Cu, Hg and Au content: those solutions which had removed the least material from the plate during cleaning were judged to be the best conservation treatment.

Part I: Comparison of Solution Types

Daguerreotypes have been cleaned in a number of ways since their invention. Historically, the tarnish was cleaned by immersion in a solution of potassium cyanide (2). The toxicity of this chemical, however, eliminated it as a conservation treatment to be considered in this study.

The commercial immersion cleaners for silver objects consist of an acidic solution of thiourea, which is claimed to act on the tarnish without disturbing metallic silver (2). Similarly, the action of thiosulfates has been reported to be selective for the removal of stains of silver sulfide and finely divided metallic silver on photographs, without touching the coarser silver of the image (3). Ammonium thiosulfate has been used by artifacts conservators also, to clean tarnished silver objects (4).

In order to test the effect of each solution on metallic silver, clean sterling silver coupons were placed in each of the published preparations in common use (Table 1). Sterling sheet is 92.5% Ag and 7.5% Cu, and both elements were monitored in the baths using atomic absorption spectrophotometry. The analytical techniques used are described in Appendix 1 (a). The total amounts of silver and copper removed from 1 cm^2 of clean sterling sheet in two 2.5 minute baths separated by a rinse in distilled water are given in Table 1.

Contrary to the claims of references (2) and (3) above, removal of silver was observed with all solutions. The data further indicates that the thiosulfate solutions were significantly more reactive with respect to both silver and copper in the sample coupons than the thiourea solutions. However, prolonged immersion in any of these cleaning solutions will result in the removal of metal from the daguerreotype; cleaning action does not stop completely when the tarnish is removed.

In order to compare the action of the solutions on an actual daguerreotype, pairs of solutions were tested on a tarnished plate. Two daguerreotypes were chosen for the test which had visually about the same amount of tarnish on each half of the plate. The back of the plate was protected with Krylon, a coating consisting of a copolymer of methyl and n-butyl methacrylate. Half the plate was then cleaned with a particular solution type, using fresh baths changed at 2.5 minute intervals with a 2.5 minute rinse after each. The baths were continued until the daguerreotype was judged subjectively to be cleaned of tarnish.

Daguerreotype 1 was used to compare the thiosulfate/formic acid solution (D in Table 1) to the stronger thiourea/acid solution (A in Table 1). Daguerreotype 2 was used to compare the two thiourea/acid solutions (A and B in Table 1). The results of the tests are shown in Table 2.

TABLE 1. Daguerreotype cleaning solutions and their effects on untarnished sterling silver

Composition		pH	Reference	Metal removed	
				μg Ag/cm^2	μg Cu/cm^2
A	70 g thiourea 0.8 ml H_3PO_4(85%) 2 ml Photoflo 200* distilled water to 1 litre	2.3	Field(s)	2.7	4.4
B	6.5 g thiourea 0.7 ml H_3PO_4(85%) 0.1 ml Photoflo 200* distilled water to 900 ml	2.4	adapted from A	0.22	2.8
C	300 ml Kodafix** 30 g citric acid distilled water to 1 litre	3.4	Henn et al. (3)	12	6.0
D	330 ml Kodafix** 30 ml formic acid (90%) distilled water to 1 litre	2.8	adapted from C	17	7.2

* Photoflo 200 is a non-ionic wetting agent available from Kodak, Inc.

** Kodafix is $(NH_4)_2S_2O_3$, with some H_2BO_3 and $Al_2(SO_4)_3$, and is available from Kodak, Inc.

TABLE 2. Comparison of treatments on a tarnished daguerreotype (continued until clean)

Daguerreotype 1: Solution D (thiosulfate/formic) vs. Solution A (strong thiourea)

	ppm Ag in bath	ppm Cu in bath
D-1	5.1	9.2
D-2	2.4	15
D-3	1.5	21
D-4	1.1	22
D-5	1.5	25
D-6	1.0	26
Total	47 $\mu g/cm^2$	440 $\mu g/cm^2$
A-1	5.2	2.7
A-2	1.5	2.6
A-3	0.60	2.2
Total	32 $\mu g/cm^2$	33 $\mu g/cm^2$

Daguerreotype 2: Solution A (strong thiourea) vs. Solution B (weak thiourea)

	ppm Ag in bath	ppm Cu in bath
A-1	3.9	1.0
A-2	0.53	0.78
Total	23 $\mu g/cm^2$	9 $\mu g/cm^2$
B-1	2.5	0.97
B-2	0.15	0.78
B-3	0.11	0.82
B-4	0.12	0.89
B-5	0.087	0.86
B-6	0.046	0.83
B-7	0.034	0.72
B-8	0.022	0.76
B-9	0.037	0.84
B-10	0.016	0.69
B-11	0.017	0.66
B-12	0.014	0.72
B-13	0.014	0.78
B-14	0.016	0.86
B-15	0.016	0.82
Total	15 $\mu g/cm^2$	55 $\mu g/cm^2$

The results show that for all cleaning baths, the concentration of silver decreases in successive baths. This confirms the selectivity of the baths in removing the more easily dissolved silver sulfide tarnish. The concentration of copper remains relatively constant in the baths of each series. The removal of copper from the daguerreotype occurs in a different way than for silver. There was no readily soluble copper compound which would be removed in the initial baths, and so the copper comes into solution from the metal of the plate at a fairly even rate, whether early or late in the cleaning sequence. Clearly, the process which takes the greater number of baths to effect cleaning removes proportionally more copper from the plate, and this is confirmed by the experimental data.

It can be concluded from the experiments described above that with respect to the removal of major constituents of the daguerreotype, the thiourea type solutions tested are less damaging in their cleaning action than the thiosulfate solutions described in the literature. Even the thiourea solutions, however, will continue to remove small amounts of silver and copper metal from the plate on prolonged immersion.

In the comparison of the two thiourea solutions performed on Daguerreotype 2, it can be seen that the weak solution is much slower to remove tarnish, requiring 15 baths. It has been deduced by Brenner (2) that the relationship for the rate of tarnish removal can be expressed as:

$$\text{Rate} = k\,[\text{thiourea}][\text{acid}]\text{, at constant temperature.}$$

The time required for a complete cleaning of a plate, then, can be adjusted by changing either the thiourea concentration or the pH. The ultimate choice of a cleaning method will be dictated by minimum removal of material from the plate and image. Before refining the thiourea/acid concentrations to provide optimum conditions for cleaning, it was considered necessary to examine the effects of the cleaning process on the other constituents of the daguerreotype, mercury and gold.

Part II: Effects of Cleaning on Minor Constituents

a) Mercury

Despite the fact that there is not a great quantity of mercury present in a daguerreotype plate, it is an essential constituent of the image. Tests were performed to observe the relative amounts of Hg removed from an amalgam at various pH levels and thiourea concentrations.

The baths tested were made up of thiourea at the concentrations of 0, 0.1 and 1.0 M, with each solution being divided into three and the pH adjusted to 2, 4 and 6 using H_3PO_4 and NaOH. Small coupons of sterling silver were spread with liquid Hg and allowed to stand for 2 weeks; a coupon of area about 2 cm^2 took up an average of 2 mg of mercury on amalgamation. The coupons were placed in the solutions for 5 minutes each and the resultant solution was analysed by atomic absorption spectrophotometry, using the techniques described in Appendix 1 (b).

In general, the removal of Hg by the cleaning solution increased with acidity and the concentration of thiourea. The low levels of Hg removed by the treatment caused experimental difficulties in measuring the Hg concentration. As an example of the order of magnitude of the amount of Hg removed, in one sample treated with the 1 M thiourea/pH = 2 solution, roughly 0.5 μg of Hg was removed from the original deposit of 2mg.

In order to examine the effects of the cleaning solution on the Hg of an actual daguerreotype, a modern plate was made under controlled conditions (7). A series of tests was performed to compare the Hg removal in tarnished and untarnished image areas. The range of solutions described above was used plus a saturated thiourea solution (almost 2 M). The results, although once again complicated by the difficulty in detecting the low levels of Hg, appear to indicate that Hg is more easily removed from a tarnished surface than a clean one. This result is significant in that it indicates the possible formation of mercury sulfide compounds on tarnishing, which are more easily dissolved in the solution than is the metal of the amalgam. In addition, this indicates that any attempt to optimize the processing conditions must take into consideration the removal of mercury, a key constituent of the image.

b) Gold

It had been observed during the early cleaning tests on actual daguerreotypes that gold was present in all cleaning solutions at the part per billion level. As with the mercury analysis, flameless atomic absorption spectrophotometry was used for the analysis as described in Appendix 1 (b).

The amount of gold available on the surface of a gilded daguerreotype can be estimated from the electron microscopy work of Fiori and Heinrich (1) at 24 $\mu g/cm^2$. In our laboratory, prolonged immersion in aqua regia of pieces of modern daguerreotype yielded results in the range of 50 - 100 $\mu g/cm^2$ with further gold still undissolved on the daguerreotype surface.

In the experiments related to the Hg investigation described above, gold was monitored in the cleaning solutions. Even after hours of immersion under extreme conditions, the concentrations in the baths corresponded to a maximum loss of gold in the order of 0.05 $\mu g/cm^2$. It is dubious whether the total amount of available gold would be significantly affected by a thiourea treatment. Gold would, however, be removed (if not dissolved) by any treatment which dissolved its support, either the image amalgam particles or the silver sheet.

Conclusions

As a result of this work, it is considered that of the published daguerreotype cleaning solutions studied, thiourea/acid solutions can be recommended as the most reasonable treatment. The critical parameters of time of immersion, acid and thiourea concentration were examined with respect to their effects on the removal of mercury and gold. Further studies are in progress which will examine the effects of these parameters on silver and copper removal. It is suggested that a clear definition of the relationship of these variables will lead to the development of a set of optimum conditions for the cleaning of daguerreotypes and other tarnished silver artifacts.

Appendix 1 (a): Atomic Absorption methods for Ag and Cu

Silver and copper were determined by flame AAS, using C_2H_2/air. The burner was turned parallel or perpendicular to the light beam as dictated by the concentration range of the solutions. Hollow cathode lamps were used; Ag was determined at 328.1 nm and Cu at 324.7 nm. Standards were made up in solutions matching the samples in composition.

Appendix 1 (b): Atomic Absorption methods for Hg and Au

Due to the very low concentrations of these elements, flameless AAS was required. The graphite furnace accessory (HGA 2000) to the Perkin-Elmer system was used in this work. Sample preconcentration was also necessary, and this was accomplished with an extraction into methyl isobutyl ketone (MIBK) using ammonium pyrrolidine dithiocarbamate (APDC). Extraction and analysis was done as soon as possible after the cleaning solutions were used, as Hg in particular is unstable in solution.

The APDC solution is prepared as follows: grind 5 g of APDC with 50 ml of acetone, collect the solid in a porosity 3 sintered glass crucible, wash with 20 ml acetone, dry in air and dissolve 1 g of the dried material in 100 ml of distilled water. This solution should be filtered before use. The extraction then proceeds: to a 25 ml aliquot of cleaning solution, add 3 ml of APDC, adjust the pH to 5 with H_3PO_4 or NaOH, add 1.5 ml MIBK and shake for 1 minute.

Calibration should be done by the method of standard additions. Spikes of both Hg and Au can be added to the same sample aliquot for extraction and analysis. For the determination, 50 μl aliquots of the MIBK extract are injected in triplicate into the graphite furnace. The drying and atomizing cycles were 150°C for 30 seconds and 2000°C for 5 - 10 seconds. Background correction using a deuterium arc lamp was necessary. For Hg, an electrodeless discharge lamp was used at 253.6 nm, and for Au, the hollow cathode lamp emission at 242.8 nm was used.

References

1. Swan A., Fiori, C.E., and Heinrich, K.F.J., "Daguerreotypes: A Study of the Plates and the Process", Scanning Electron Microscopy, I (1979) pp 411-424.

2. Brenner, H., "Tarnish Removing Dips for Silver, Gold and Copper", Electroplating and Metal Finishing, 6 (1953) pp 171-173.

3. Henn, R.W., Crabtree, J.I., and Russell, H.D., "An Ammonium Hypo Reducer", J. Photographic Society of America, Nov. (1951) pp B110-113.

4. Holm, S., "Silver", Institute of Archaeology, University of London, May (1969).

5. Method for the restoration of daguerreotypes used by the Missouri Historical Society, devised by Mrs. Ruth K. Field, Assistant Curator. Quoted in Ostroff, E., "Preservation of Photographs", The Photographic Journal, October (1967) p 313 and Ostroff, E., "Conserving and Restoring Photographic Collections", American Association of Museums, Washington, D.C. (1976).

6. The mercurized daguerreotype plate was made by I. Pobboravsky, Rochester Institute of Technology.

81/23/2

COMMENTS ON X-RAY FLUORESCENCE QUANTITATIVE ANALYSES OF ANCIENT SILVER ALLOYS

Hanna Jedrzejewska

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Metals

COMMENTS ON X-RAY FLUORESCENCE QUANTITATIVE ANALYSES OF ANCIENT SILVER ALLOYS

Hanna Jedrzejewska

Solec 109a / 39
00-382 Warsaw
Poland

Abstract: the intention of this paper is not to consider the method in itself but to discuss certain factors in the final interpretation of experimental readings, connected with the limit of validity of modern standards and the representative qualities of analysed samples. The conclusion is that physicists may perhaps give more attention to matters of methodology in quantitative determinations by XRF methods.The problem is presented on the example of Ag-Cu alloys.

x

x x

GENERAL INTRODUCTION

X-ray fluorescence is a very convenient non-destructive analytical method successfully used in industry and recently also often applied for the examination of ancient metal objects.As all other methods also this one has its limitations in application and reliability. Before a final interpretation of the direct analytical readings it is necessary to properly evaluate the real relations between experimental data and their assumed meaning.

Some of these limitations in analyses of ancient metal are already recognized and more or less taken into acoount.They concern the representative qualities of the sample in a corroded object. But some questions may also be asked about the influence of corrosion changes in samples on the validity of comparison with modern standard alloys,which is a basic operation in XRF methods of quantitative determinations, carried out to convert experimental physical readings into the final chemical interpretation.

Very little,if any,attention is given to these relations, but as it seems they may be of basic importance in the final conclusions on the quantitative composition of analysed ancient alloys.

Considerations here have to start with a brief recapitulation of basic methodological principles in quantitative analysis. There are, generally, three different kinds of procedures for the determination of proportions of components in composite substances :

1/ direct determination by chemical means. This is the most reliable way as concerns results. A fragment of the analysed substance, large enough to be weighed, is separated from the bulk material, and the amounts of particular components are determined by chemical means, all for the same piece of substance. The contribution of particular components (in percents, in weight proportions) can be directly calculated in relation to the weight of the sample (=100%). The method is "destructive".

2/ indirect determination by chemical means. These methods are applied in cases when the sample is too small to be weighed, or when it is more convenient to analyse larger samples by such means. The determinations are still made by direct methods of analytical chemistry, but with the help of comparative standards of known composition and known concentration of components. The sought relations are deduced from comparison of readings for the unknown and the standard. Here belong colorimetry, chromatography, etc. These determinations are based on the assumption that identical substances give identical chemical effects with a particular reagent , in the same conditions of testing. This method also is destructive , because samples have to be separated from the bulk material.

3/ indirect determination by physical instrumental methods. These methods are recently finding a growing application for analyses of ancient objects. They are considered as non-destructive because there is no need of separating the sample from the bulk material. But the measured physical effects have no direct chemical meaning and have to be "translated" into chemical terms. This is done by comparison with effects given by standards of possibly similar composition as the unknown. The identity of responses to physical stimuli from both materials makes a base for quantitative determinations. But there are certain methodological requirements that must be kept in order to obtain correct final results.

METHODOLOGICAL PRINCIPLES IN QUANTITATIVE ANALYSES

Generally, between observed effect and final conclusion (= "result") there is a logical sequence of steps allowing to connect the experimental facts with conclusions on quantitative composition. This "logical path" is built of direct observations connected with a certain number of assumptions.It is a basic methodological principle that to have a reliable final result it is necessary to give proper attention to a l l successive logical steps without omitting some as "evident" or "self-understood". Besides,the particular assumptions have to be evaluated as concerns their correctness.

In the first group of analytical procedures (determination by chemical means) the experimental readings are directly representing the sought information.No connecting assumptions are necessary.

In the second group of procedures standards have to be used and the necessary assumption will be that the chemical behaviour of standards will be identical with the chemical behaviour of the unknown.But all remains in the field of chemistry.

In the third group of analytical procedures there is a marriage of physical effects and chemical conclusions. The logical path of reasoning is much longer here,and several assumptions have to be made. The first one of them is that chemical substances of similar composion and internal parameters will respond to physical stimuli in identical or comparable way.This assumption has a high grade of probability.In indirect determinations also the reverse of this is assumed to be true,that means that identical responses to physical stimuli in closely related substances are proof of their identity of composition. This assumption may,or may not,be true.Before such a conclusion is made it is necessary to become certain that the internal parameters of the standard and the unknown are identical.A very often committed misinterpretation is in the assumption that this reverse process a u t o m a t i c a l l y takes place.

Matters of identity of internal parameters are less pronounced for modern newly made materials.They may be very serious for ancient corroded alloys.

CHANGES OF COMPOSITION IN ANCIENT ALLOYS

In aggressive environment metals are subject to different processes of corrosion.In the preferential corrosion in alloys one of the components is more readily attacked than the other and it may be carried away from the metal,first on the surface and then deeper in.Thus the alloy may lose one of its components with an apparent "enrichment" in the other one.Especially sensitive to this kind of change are Ag-Cu alloys,and copper is the component that goes out.Silver stays in place. The density of the corroded alloy becomes lower than it was and the internal structure is changed.Hence,the parameters of the uncorroded and corroded alloy,of originally the same composition, become significantly changed.

This in turn may have influence on the validity of assumptions in the logical steps of quantitative analysis. As concerns density it may also happen that the density of the unknown Ag-Cu alloy may be higher than usual-and this in depressions in coins struck with dies.

QUANTITATIVE DETERMINATIONS BY X-ray FLUORESCENCE

This is an indirect non-destructive instrumental physical method largely applied for quantitative analyses of alloys in ancient metals.It is based on the fact that metal atoms,when irradiated with X-rays of very high energy, become "excited" and give emission of secondary X-rays of wavelengths specific for each particular element.These effects can be measured by spectrometric means.The presence of a particular wavelength in the X-ray spectrum is a confirmation of the presence of the relevant chemical element,and the intensity of the received response (impulse) is proportional to the number of responding atoms.

This effect is used for quantitative determinations of components in ancient alloys.Two kinds of primary sources may be used for excitation: either X-ray tubes with a continuous("white") spectrum,or different radioisotopes with particular wavelengths and energies of X-rays. The second technique is more selective.

As in all indirect physical methods the physical data have to be "translated" into chemical terms with the help.of comparative standards.Usually,calibration curves are prepared for the standards (magnitude of response versus percentage of investigated component in the alloy) and this serves as measure for responses received from the unknown in the same testing conditions.

For Ag-Cu,calibration curves are prepared for different proportions of components,also for pure silver when only the fineness of Ag in objects is measured. It is of course assumed that not only the responses will be identical for materials of similar composition,but also that the reverse automatically is true,which means that similar responses are proof of the quantitative identity of standard and the unknown. Hence,the composition of the unknown is expressed in percents descriptive for the standard.Is this unconditionally correct ?

<u>Example 1</u>. The problem may be illustrated with the following example (diagram 1) : let's imagine a very thin layer of Ag-Cu on a non-reactive support. A -is the standard (50% Cu-50% Ag) and B -the corroded unknown.Measured is the Ag content.Both give the same intensity of response.The answer based on calibration curve will be 50% Ag also for B. But owing to preferential corrosion copper is out and only pure Ag has remained.By wet chemical analysis the result will be 100% Ag! Something quite obviously is wrong. What is the meaning of the 50%

as determined by XRF? To what basic quantity is this percentage referred to ? The general cause of the problem lies in a basic difference of internal parameters of the standard and the unknown. As it seems, this factor is not taken into account in XRF quantitative determinations and, hence, maybe the cause of "unexplained" divergences in results of analyses carried out by different methods.

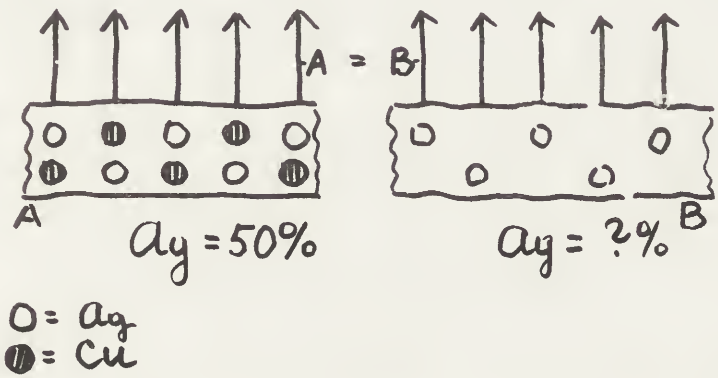


Diagram 1. Determination of Ag content, by XRF.

A = standard Ag-Cu alloy (50% Ag, 50% Cu),
B = old alloy, after preferential corrosion.

Identical intensity of response to irradiation.

The source of problems in the described case lies in the fact that the internal parameters of standard and sample were not taken into consideration. It must be said here that the evaluation whether a coin is in "mint condition" ,or just looks like it (surface rich in silver, nicely polished after cleaning), is quite a problem in itself. Conclusions based solely on appearance may be very misleading and proper testing is full of problems.

Example 2. There also are other factors that could lower or invalidate the value of quantitative determinations by XRF. These factors are connected with the depths of penetration, as well of excitation rays into the alloy as of secondary X-rays o u t of the metal. The d e p t h of a n a l y s i s depends to a greater extent on the ability of the secondary X-rays to escape from the sample without being absorbed (all in the range of 0,001 mm or less). And the percent of total received information comes mostly from layers nearest to surface with much less response from deeper layers.

So, generally, the response from examined sample will depend not only on the energy of incident primary X-rays but also on the density of the alloy (different depths of penetration) and different matrix effects. Under these effects understood are all interactions between the components of the alloy and the incident as well as the emitted radiation. The matrix effects will of course also depend on the density of the alloy and on its components. All these parameters are not easily controlled and quite certainly will be different for the material used as standard and the old corroded alloy.

Some of these relations are illustrated on diagram 2; it concerns an Ag-Cu alloy of thickness greater than the "depth of analysis". There is the standard and the corroded sample (Cu partly missing). Selective radioisotope sources of different energies are used for excitation, with emission energies best suited to particular elements and the energies of their electron levels (outer K and L electrons). In the presented diagram :

- A is the standard, with (a) analysis for Ag, and (b) analysis for Cu. The information (response) will quite obviously be coming from different depths, one reason for this being a source of incident X-rays of different energy. Additionally, the matrix effects will be stronger with deeper layers of the alloy; in (c) represented is a second analysis for Ag, made with incident radiation of higher energy, deeper penetration and electrons excited on different levels. Again, uncontrolled influence of matrix, and reduced amount of information from deeper layers.
- B is the old corroded alloy. Here there will not only be the already described set of influencing factors but also the non-uniformity of composition due to preferential corrosion, and the difference of density as compared with the standard. Could be interesting to know and measure these different responses, but very difficult and risky to go too far in comparison and conclusions. Added here should be factors mentioned in example 1. and concerning the relations between corroded sample and measurements done for modern alloys.

Both presented examples are of course very simplified as concerns presentation and rather exaggerated in their alarming tone. Their problems should not be overlooked in practice even that solving them in a practical way does not seem possible.

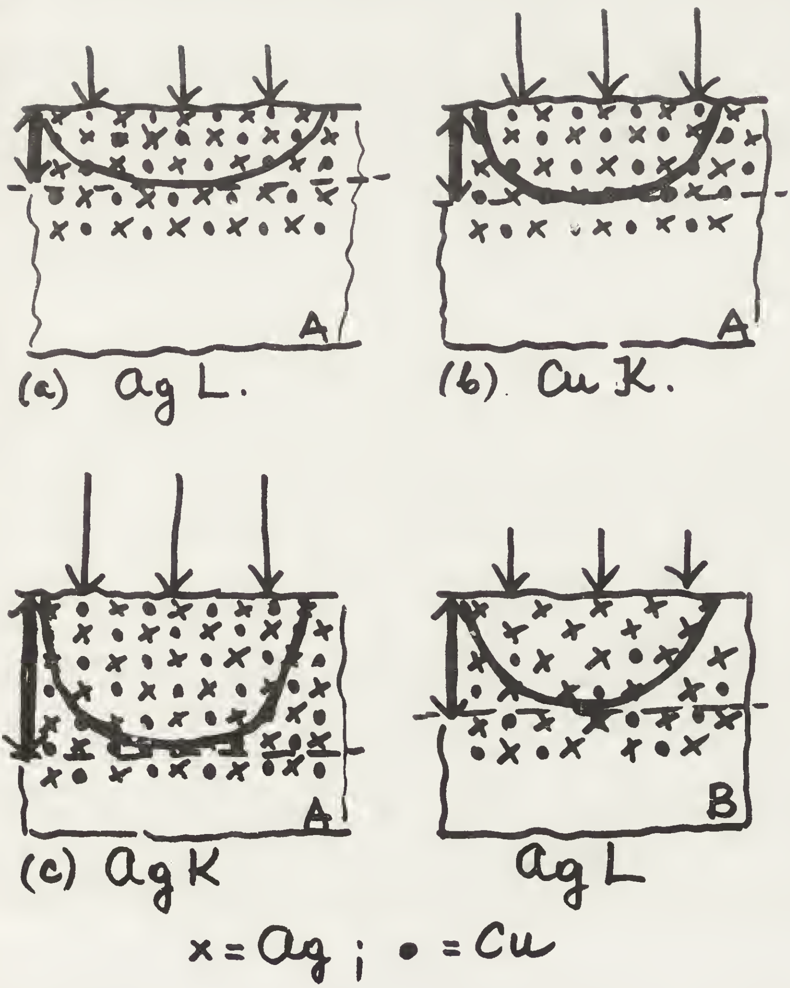


Diagram 2. Depths of penetration of X-rays from different sources.

A = standard Ag-Cu alloy (50% Ag-50% Cu).
B = old corroded Ag-Cu alloy (Cu partly carried away).

Depth of penetration and depth of analysis depend on the energy of incident radiation and on the density of the alloy.

THE SAMPLE AND ITS REPRESENTATIVE QUALITIES

Generally,the term "sample" means the analysed fragment. It may be separated from the main substance or just stay in place. In any case,it is supposed to represent a larger area in a reliable way.

The sample,in fact,is truly representative only of itself.On the theory of probability its properties may be extended to a larger area.How far this should be allowed depends on the size of the sample,the size of the represented area,the homogeneity of the sample and the heterogeneity of the analysed material as a whole.The smaller the sample in comparison with the represented area,and the greater the heterogeneity of this area - the lower the representative qualities of the sample.This relation concerns a l l analytical procedures based on samples.

So,the problems of proper quantitative analytical data in X-ray fluorescence methods will not only be connected with relations between sample and standard,but will go further to relations between sample and analysed bulk of material.At that,XRF samples are extremely small in size and located at the surface which is the part most open to corrosion. Hence,the necessity of posing a very important question about the real accuracy of XRF determinations.

To make things more difficult,the size of sample in XRF analyses can not be exactly delimited.The surface area is determined by the diaphragm for incident radiation.But the depth of the "sample" (= analysed area) will be different in dependence of test conditions,even in the same analytical program, as demonstrated in diagramm 2.

In the view of all these complications it is difficult to agree with some authors estimatimg the accuracy of the XRF method as very high (less than 1% of error). This of course may be correct for the accuracy of direct physical readings,but not for chemical data deduced by indirect methods.Here,the accuracy can be much lower owing to different disturbing factors.

FINAL COMMENTS

It would be difficult to say how far the mentioned factors tors will have a practical influence on XRF determinations. But they should never be neglected and in written reports enough attention should be given to evaluate their possible interference.Unfortunately there is at present very little attention paid to "factors of uncertainty".Though,the XRF method is rather largely applied .And the conclusions from analytical measurements are far going and extensive.

This is very much in need of a critical assessment.

Reconsidered in detail should be all interfering factors connected with samples,standards,corrosion ,analytical conclusions ,etc.,and their possible contribution in making the quantitative determinations less reliable.

Coins may be especially sensitive as concerns errors in accuracy.The numismatists are basing very strongly in their conclusions on analytical data. And these have to be reliable .But coins are small and thin things strongly exposed to corrosive processes .Hence,their alloys may be very gravely injured ,especially on the surface.Over-optimistic confidence in analytical data without proper critical restraint may lead the numismatist out of the right way in his studies and research.

The presented considerations may as well concern not only coins but also other Ag-Cu objects,and not only Ag-Cu alloys though in different degree.

For many analytical cases,not only of Ag-Cu alloys , there is no good agreement between XRF determinations and analyses done by other methods,also the most reliable wet chemical techniques.As it seems the whole matter needs a thorough reconsideration of relevant factors and their influence on the final analytical conclusions,because the main point lies not in measuring but on the proper interpretation of what was measured.

Maybe the physicists will be able to help in answering these questions ? And in giving a critical assessment of the real "level of confidence",a matter of basic importance to all numismatic research ?

BIBLIOGRAPHY

1/ Hanna Jedrzejewska.Sampling precautions in the analysis of metallic antiquities. Studies in Conservation, 1962, No.1 , 27-32.
Matters of corroded ancient alloys and of sampling are reviewed.15 notes and references.

2/ Hanna Jedrzejewska.Analytical problems in a museum laboratory.Report.ICOM Congress.Madrid 1972.
Considered are methodological principles of taking samples,presenting the results,and"personal factors",

3/ Hanna Jedrzejewska.Some comments on methods of investigation of ancient coinage (in Polish).Wiadomosci Numizmatyczne,20,1976,100-110; 21,1977, 35-45,and 112-118.
Discussed is the general methodology of analytical procedures,the choice of method and sample,the presentation of results,with attention to possible misinterpretations.A review is given of papers presented at the Numismatic Symposium,London 1970 (see below).

4/ Methods of chemical and metallurgical investigation of ancient coinage. Papers from a Symposium. Royal Numismatic Society, London 1970.
There are many papers connected with problems presented in this report. Of special interest may be papers by Condamin and Picon, and by Cope.

5/ ARCHAEOMETRY. Journal published by the Research Laboratory for Archaeology and the History of Art. Oxford University.
There are several papers on preferential corrosion and XRF analyses of alloys, with examples for discussion.

6/ Ch.M.Dozinel. Modern methods of analysis of copper and copper alloys. Book. Elsevier. London 1963.
Good critical remarks on sampling and general methodology.

7/ T.Florkowski and Z.Stos. Non-destructive radioisotope X-ray fluorescence analysis of old silver coins. Archaeometry, 1975, 17, 165-175.
Several points for discussion as concerns methodology.

NOTE: no references to bibliography are given in the text of the Report, because there would be a complicated cross-linking of particular fragmentary informations and critical remarks.

January 1981

Hanna Jedrzejewska,
ICEC,
Stockholm-Warsaw

81/23/3

BRONZE DISEASE: SYNTHESIS AND CHARACTERISATION OF BOTALLACKITE, PARATACAMITE AND ATACAMITE BY INFRA RED SPECTROSCOPY

N.H.Tennent and K.M.Antonio

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Metals

BRONZE DISEASE: SYNTHESIS AND CHARACTERISATION OF BOTALLACKITE, PARATACAMITE AND ATACAMITE BY INFRA RED SPECTROSCOPY

N.H.Tennent and K.M.Antonio

N.H.Tennent
Glasgow Museums and Art Galleries
Art Gallery and Museum
Kelvingrove
Glasgow G3 8AG
Great Britain

K.M.Antonio
Scottish Development Department
(Ancient Monuments)
17 Atholl Crescent
Edinburgh EH3 8JN
Great Britain

ABSTRACT

The three naturally occurring isomers of basic copper chloride, Cu2(OH)3Cl, botallackite, paratacamite and atacamite, can be easily prepared from the reaction of cupric chloride with calcium carbonate, copper metal with cupric chloride and cuprous chloride with moisture, respectively. In contrast, variability in the nature of the isomer produced by other laboratory syntheses is observed. Botallackite, paratacamite and atacamite are readily distinguished by Infra Red Spectroscopy particularly in the region 900-300cm^{-1}, and this technique provides a quick and simple method for identifying the presence of one or a mixture of isomers on bronze antiquities. The Infra Red Spectra are illustrated.

INTRODUCTION

The nature and appearance of the corrosion products on bronze antiquities vary greatly and result primarily from the artifacts' previous storage or burial conditions (1). Sulphates, nitrates, carbonates, phosphates, oxides and sulphides of copper have been identified in specific cases (2-6) but it is the presence of basic copper chloride, $Cu_2(OH)_3Cl$, which most strongly indicates active corrosion. This compound, pale-green in colour and generally powdery in appearance, is commonly known as bronze disease. The corrosion processes leading to the formation of bronze disease have been well described by Organ (7) and several methods of treatment have been proposed (8). The most common current method for stabilisation of bronzes against further corrosion is the application of the copper corrosion inhibitor, benzotriazole (BTA) (9).

Although effective in many instances, the use of BTA is not always totally successful in preventing further outbreaks of bronze disease (10). In addition, whereas the mechanism of inhibition of copper by BTA has been well studied (11) the mode of its action on corroded bronze antiquities has not been established.

The origins of this report lie in the need to simulate bronze corrosion and to identify the crystalline products formed, prior to investigating the inhibiting action of BTA. It became clear that published reports contained conflicting results on the precise characterisation of basic copper chloride. Documented laboratory syntheses also showed variability in the form of basic copper chloride produced.

The synthesis and characterisation of this crystalline compound is complicated by the fact that three different polymorphs are found in nature. These three polymorphs, botallackite, paratacamite and atacamite, have the same chemical formula, $Cu_2(OH)_3Cl$, but different molecular structures; they are isomers. Another copper hydroxy chloride, $Cu(OH)Cl$, is unstable, but can be prepared artificially. It may be involved in copper corrosion mechanisms but cannot be detected due to its instability.

Reports of the identification of basic copper chloride by X-Ray Diffraction (XRD) have in some cases produced conflicting results. A fourth polymorph proposed by Feitknecht and Maget (12) was subsequently found to be a mixture of atacamite and paratacamite (13). Barton and Bethke identified the formation of atacamite from the reaction of cupric chloride and sodium hydroxide (14) whereas elsewhere the product of this reaction is identified as paratacamite (15). In a study of Egyptian pigments (16), XRD was used to identify atacamite and to show that basic copper chloride occurs naturally only as pure atacamite or as a mixture of atacamite and paratacamite, a conclusion which, on the basis of other investigations, is clearly untenable.

The presence of basic copper chloride on bronze antiquities has been recorded in many reports. Paratacamite and atacamite have been reported most frequently though a specific characterisation has probably been made in only certain cases. Gettens reports the common occurrence of atacamite with colours ranging from emerald to blackish green (2), the dark green crystalline atacamite being often altered to paler green powdery paratacamite. Paratacamite has been specifically identified, by XRD, as the corrosion product from bronze artifacts (1,17), and appears to be more widespread than atacamite (17). The presence of botallackite on ancient bronzes is even less well documented (17) but it has been suggested (4) that its occurrence is probably more common than has been suspected.

EXPERIMENTAL

Authentic samples of the minerals paratacamite and atacamite were obtained from the Natural History Department, Glasgow Museums and Art Galleries. X-Ray Diffraction studies were conducted by Dr A Livingstone, Department of Geology, Royal Scottish Museum. I.R. spectra were recorded by Mrs F Lawrie, Department of Chemistry, Glasgow University, on a Perkin-Elmer Model 580 Ratio Recording Spectrophotometer using 1 mg samples prepared as KBr discs.

Synthesis of Basic Copper Chloride

Botallackite

Calcium carbonate (22.2 m mole) was added to 0.13M cupric chloride solution (1000ml). The suspension was left unstirred for 1 day and the pale green, powdery product then filtered, washed with water, dried and identified as pure botallackite by I.R. spectroscopy.

Paratacamite

A rectangular sheet of copper foil was suspended in 0.02M cupric chloride solution and the solution stirred for 2 days. The precipitate was filtered, washed with water and identified as pure paratacamite by I.R. spectroscopy.

Atacamite

i) Cuprous chloride was sprinkled finely over moist filter paper and left exposed to the atmosphere for 3 days. The pale grey-green product was washed with water, dried and identified as pure atacamite by I.R. spectroscopy.

ii) Calcium carbonate (21.2m mole) was added to 0.13M cupric chloride solution (1000ml). The suspension was stirred for 13 days, filtered and the pale-green powdery product washed with water, dried and identified as pure atacamite by I.R. spectroscopy.

RESULTS AND DISCUSSION

Several methods have been reported for the laboratory synthesis of botallackite, paratacamite and atacamite:

I Botallackite

1. By the reaction of brochantite ($CuSO_4 \cdot 3Cu(OH)_2$) with a solution of sodium chloride at 25^{o}C for 48 hours with no stirring (18).

2. By treating sodium hydroxide solution with cupric chloride so that the alkali remains in great excess (12). c.f. II.5.

II Paratacamite

1. By spraying sea water on to brass or copper sheets at 85^{o}F (17,19).

2. By exposing cuprous chloride to a moist atmosphere or sprinkling it over moist filter paper (17,20).

3. By placing crinkled sheets of copper over filter paper moistened with extremely dilute hydrochloric acid (17).

4. By suspending copper foil in a cupric chloride or sodium chloride solution and stirring at room temperature for 48 hours (12,18).

5. By direct precipitation of a cupric chloride solution with sodium hydroxide (15). c.f. I.2.

6. By immersion of copper, cuprous oxide or cuprous chloride in a sodium chloride solution of any concentration or in a cupric chloride solution more dilute than 0.025M, and allowing the mixture to stand exposed to the air (12,15).

III Atacamite

1. By the addition of calcium carbonate to cupric chloride solution, followed by stirring for 2-4 hours (15).

2. By the slow removal of ammonia vapours from 1M cupric chloride containing excess ammonium hydroxide (13, 15, 18).
3. By immersion of magnesite or calcite spar crystals in dilute cupric chloride for a prolonged period (15, 18, 21).

Many of these reactions have been examined in the course of this investigation but several have been found to give variable results. In some cases the isomer produced is unpredictable while in others a mixture of isomers may be formed. The reaction of cupric chloride with calcium carbonate (III.1) produced atacamite when the components were stirred but botallackite when unstirred. The observation was not reported by Sharkey and Lewin who proposed this method of preparation of atacamite (15). The dependence of the reaction product on stirring has, however, been previously stressed by the same authors in their preparation of botallackite (I.1). If this reaction mixture is stirred the product is paratacamite. The reaction of cupric chloride with sodium hydroxide, proposed as a method of synthesis of paratacamite (II.5) has in our hands in three separate experiments produced botallackite, atacamite and a mixture of botallackite, atacamite and paratacamite. Botallackite has been reported as the product of this reaction if the alkali is in great excess (I.2) but in the present work equimolar (0.5M) solutions were used.

The syntheses reported in the Experimental Section represent the most reliable methods for preparation of each of the isomers. The methods described gave consistent results when carried out in triplicate. It is noteworthy that the product of reaction of cuprous chloride with moisture, the basic reaction occurring in ancient bronzes, is invariably atacamite. In contrast, the reaction of bronze or copper foil with cupric chloride and water, a reaction which may be implicated in the formation of bronze disease on bronze artifacts produces invariably paratacamite. It was not the initial aim of this investigation to rationalise the various controlling factors which govern the production of particular isomers on ancient bronzes. It is clear however that a fuller understanding of the factors which influence the resultant isomer would be important in understanding the process of mineralisation of bronzes and could perhaps be significant in authenticity studies. It may prove possible to establish a relationship between the basic copper chloride isomer present on a bronze artifact and the object's provenance.

Various factors are clearly involved of which relative thermal stability of the three isomers is likely to be particularly important. Botallackite is unstable with respect to both paratacamite and atacamite (18). In this property may lie the explanation for the few authenticated observations of botallackite on ancient bronzes. It has also been concluded that paratacamite is more stable than atacamite (18). This corresponds to the apparently more widespread occurrence of paratacamite on bronzes.

In the face of such variability, the need for a ready means of distinguishing botallackite, paratacamite and atacamite is clear. XRD is routinely employed in the identification of mineral specimens. The technique has the advantage of small sample requirement but the equipment is expensive and difficulties can be experienced in differentiating closely related materials. I.R. spectroscopy has not been widely utilised for characterising mineral specimens but with the development of instruments which routinely extend to the far I.R., inorganic materials have become more amenable to this technique. Simplicity and widespread availability are two further practical advantages.

Samples of botallackite, paratacamite and atacamite previously identified by XRD (on comparison with data from the Joint Committee on Powder Diffraction Standards, 1973) were in fact easily distinguished by I.R. spectroscopy. The frequencies of the main absorption bands, extracted from the illustrated spectra, are given in Table 1. The characteristic bands fall into three regions which reflect the different molecular vibrations of this mineral: 3600-3000 cm^{-1} (hydroxyl stretching vibration frequencies), 1100-600 cm^{-1} (hydroxyl planar deformation frequencies) and 550-300 cm^{-1} (copper-oxygen stretching vibration frequencies). The band at about 320 cm^{-1} in each specimen is probably due to the copper-chlorine stretching vibration. The frequencies of the absorption bands for atacamite and paratacamite (the latter not however identified as this isomer) have been previously reported by Tarte (22).

The bands from 1000-300 cm^{-1} are most useful as a fingerprint for each isomer. The botallackite spectrum is totally characteristic and the strong peak at 682 cm^{-1}, not present in the other two isomers, enables its presence in mixtures to be easily recognised. The spectra of paratacamite and atacamite are more similar but pure samples can be readily distinguished. The presence of mixtures can again be identified by careful comparison of the band positions; the formation of both isomers on the surface of copper foil exposed to cupric chloride paste has been demonstrated by this method, for example (23).

I.R. spectroscopy carries the further advantage that the presence of organic species can also be identified. This is of importance in the study of the mode of action of stabilisers such as BTA which are likely to act by formation of a coordination complex with the bronze metal surface or bronze corrosion products. It is significant, for example, that the complex formed between cuprous chloride and BTA was not stabilised against further reaction. Complete conversion to a BTA-atacamite complex occurred after 72 hours' reaction with moisture (23). This observation is the subject of further investigation.

REFERENCES

1. TYLECOTE, R.F., "The effect of soil conditions on the long-term corrosion of buried tin-bronze and copper", J. Arch. Sci., 6 (1979), 345-368.

2. GETTENS, R.J., "Mineral alteration products on ancient metal objects", Recent Advances on Conservation, IIC, London, 1963, pp.89-92.

3. PANSERI, C., and LEONI, M., "The manufacturing technique of Etruscan mirrors", Studies in Conservation, 3 (1957), 49-62.

4. STAMBOLOV, T., The corrosion and conservation of metallic antiquities and works of art, Central Research Laboratory for Objects of Art and Science, Amsterdam.

5. REIDERER, J., "Spectroscopic methods in the preservation of monuments", European Spectroscopy News, 31 (1980), 39-41.

6. OLIN, J.S., "The use of IR spectrophotometry in the examination of paintings and ancient artifacts", Instrument News, 17 (1966), 1.

7. ORGAN, R.M., "Aspects of bronze patina and its treatment", Studies in Conservation 8 (1963), 1-9.

8. ORGAN, R.M., "The examination and treatment of bronze antiquities", Recent Advances in Conservation, IIC, London, 1963, pp.104-110.

9. SEASE, C., "Benzotriazole: A review for conservators", Studies in Conservation, 23 (1978), 76-85.

10. GREENE, V., "The use of benzotriazole in conservation", Paper 75/25/6, 4th Triennial Meeting, ICOM Committee for Conservation, Venice, 1975.

11. WALKER, R., "The role of benzotriazole in the preservation of copper-based antiquities", The Conservation and Restoration of Metals. Proceedings of the Symposium held in Edinburgh, March 1979, SSCR, Edinburgh, 1980, pp. 40-49.

12. FEITKNECHT, W., and MAGET, K., "Zur Chemie und Morphologie der basischen Salze zweiwertiger Metalle. XIV Die Hydroxychloride des Kupfers", Helv. Chim. Acta, 32 (1949), 1639-1653.

13. OSWALD, H.R., and FEITKNECHT, W., "Über die Hydroxidhalogenide $Me_2(OH)_3Cl$, -Br, -J zweiwertiger Metalle". Helv. Chim. Acta., 47 (1964), 272-289.

14. BARTON, P.B., and BETHKE, P.M., "Thermodynamic properties of some synthetic zinc and copper minerals", Amer. J. Sci., 258a (1960), 21-34.

15. SHARKEY, J.B., and LEWIN, S.B., "Conditions governing the formation of atacamite and paratacamite", American Mineralogist, 56 (1971), 179-192.

16. REIDERER, J., "Recently identified Egyptian pigments", Archaeometry, 16 (1974), 102-109.

17. FRONDEL, C., "Paratacamite and some related copper chlorides", Mineral.Mag., 29 (1954), 34-45.

18. SHARKEY, J.B. and LEWIN, S.B., "Thermochemical properties of the copper (II) hydroxychlorides". Thermochim. Acta, 3 (1972), 189-201.

19. ROOKSBY, H.P., and CHIRNSIDE, R.C., "The formation of basic copper chloride and its identity with atacamite", J.Soc. Chem. Ind. London, 53 (1934), 33T-35T.

20. ORGAN, R.M., "The current status of the treatment of corroded metal artifacts", Corrosion and Metal Artifacts: A Dialogue Between Conservators and Archaeologists and Corrosion Scientists, National Bureau of Standards, Washington, D.C., 1977, pp. 107-142.

21. GARRELS, R.M., and STINE, L.O., "Replacement of calcite by atacamite in copper chloride solutions", Econ. Geol., 43 (1948), 21-30.

22. TARTE, P., "Recherches sur les fréquences de déformation OH-1. Spectre infrarouge des sels basiques de cuivre", Spectrochimica Acta, 13 (1958), 107-119.

23. TENNENT, N.H., and ANTONIO, K.M., unpublished observations.

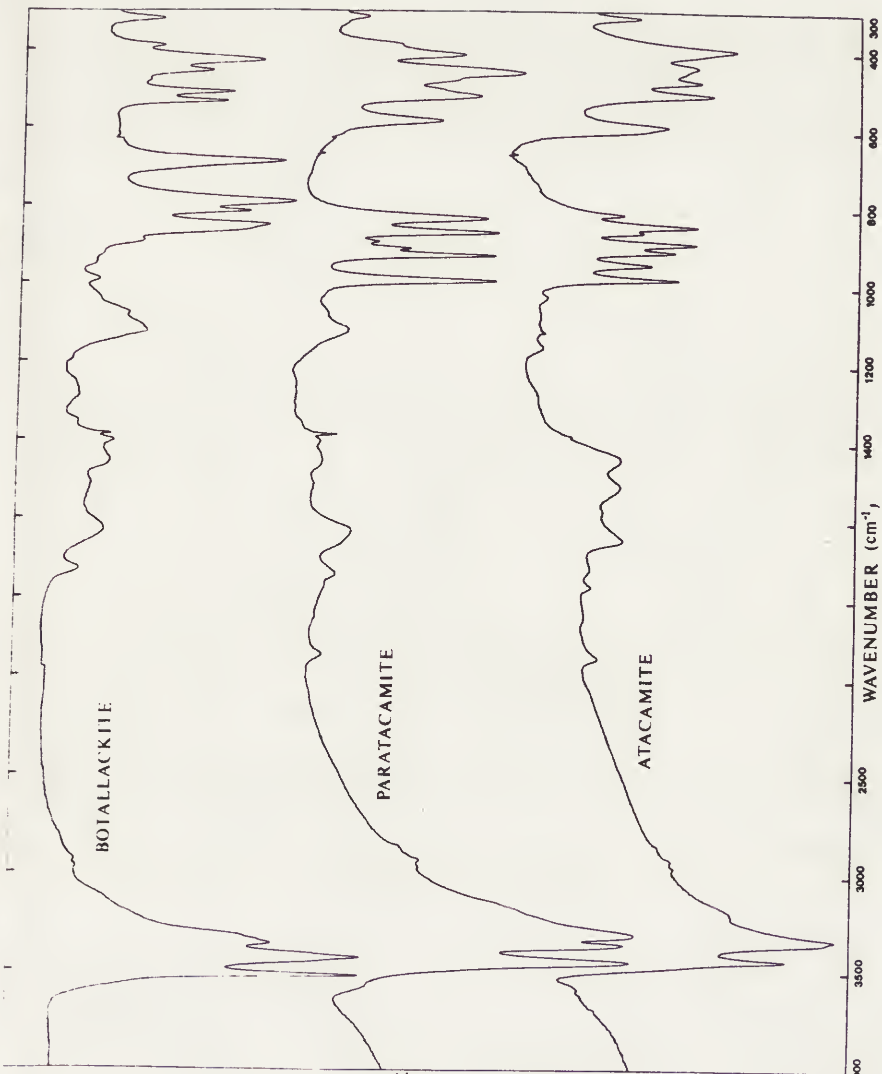
FIGURE

I.R. spectra of Botallackite (upper trace), Paratacamite (middle trace) and Atacamite (lower trace) from 4000-300 cm^{-1}.

TABLE 1 PRINCIPAL INFRA RED ABSORPTION FREQUENCIES

BOTALLACKITE	PARATACAMITE	ATACAMITE
3518 vs	3448 vs	3440 vs
3425 vs, br	3355 vs	3340 vs, br
3358 s, br	3308 vs, br	983 s
855 sh	987 s	947 m
845 s	921 s	912 s
811 m	904 w	892 s
785 s	889 w	864 w
682 s	864 s	848 s
530 m	828 s	818 w
505 m	580 s	605 sh
451 m	516 s	594 s
425 s	500 sh	512 s
389 w	475 sh	479 s
320 w	411 s	455 sh
	305 sh	440 sh
	315 w	396 s
		316 w

w = weak, m = medium, s = strong, vs = very strong,
br = broad, sh = shoulder


BOTALLACKITE
PARATACAMITE
ATACAMITE
TRANSMITTANCE (%)
WAVENUMBER (cm^{-1})
4000
3500
3000
2500
1400
1200
1000
800
600
400
300

81/23/4

KINETIC CONTROL OF THE REACTIVITY OF SOME FORMULATIONS UTILIZED FOR THE CLEANING OF BRONZE WORKS OF ART

M. Matteini and A. Moles

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Metals

KINETIC CONTROL OF THE REACTIVITY OF SOME FORMULATIONS UTILIZED FOR THE CLEANING OF BRONZE WORKS OF ART

M. Matteini and A. Moles

Opificio delle Pietre Dure e Laboratori di Restauri
Florence
Italy

Abstract

Some principal chemical cleaners used for bronze or gilded bronze works of art have been examined in order to study their behaviour with regard to metal alloy and to some more common patina components which should not be attacked during the cleaning procedure.
In this preliminary work the possible reactivity of "Rochelle Salt", of E.D.T.A. Sodium salts and of a mixture of ion-exchange resins is controlled with regard to cuprous and cupric oxides as well as to bronze alloy. Results of the kinetic study are reported particularly with respect to the selective action of Sodium Potassium Tartrate (Rochelle Salt) formulations.

1 - Premise

Products which are now usually found on surface layers of externally exposed bronze works of art and which constitute today's patina (if such a term may still be used) or which more often produce surface incrustations, widely differentiate from those found not so long ago.
With the growth of Industrialization, insoluble and therefore protective copper oxides and carbonates progressively cede their place to sulphates, nitrates and other copper compounds much less resistent to the washing out action of water and in general to the effects caused by the environment.
Furthermore the situation deteriorates with the addition of deposit and concretioning processes of atmospheric particulates; the latter are most often composed of calcium sulphates (Gypsum), various silicates and carbonates, chlorides, nitrates, carbon, hydrocarbons etc.

The so-called surface patina is therefore no more a true patina and not only for aesthetic reasons regarding colour.
The conservator who must contrast the profound changes which nowadays bronze sculpture undergo on their surface, is often forced to compromise.
The conservation operations which he has to choose are often not effective or satisfying.
In order to slow the deterioration processes it is sometimes decided to bring the work of art indoors, substituting the original by a copy.
In other cases a protective coating is applicated on the surface, although this often has a limited life-time, thus causing further maintenance problems.
Nevertheless the first important intervention which normally occurs is the cleaning of the work of art.
Washing processes with distilled water, using the normal times tollerated for such operations, is able to eliminate the easily soluble salts while it is only partially effective in the removal of the more insidious scarcely soluble salts (whose solubility is, for example, comparable to that of Gypsum).
This kind of saline compounds, which are most probably recognizable as the so-called basic salts, have a strong tendency to frequently crystallize and solubilize with respect to highly soluble salts.
Among the processes of degradation these salts must therefore be considered as highly dangerous.
As a consequence the cleaning procedure must be carried out using a delicately selective method and in such a way as to permit the complete elimination of all that may damage the work of art; conserving, on the other hand, all those components in the old patina which still today exist and which constitute a protection of the metal.
The vast experimental work for the control of the selectivity of the reagents is carried out in this first step, verifying only the non reactivity towards the principal and better known components of the so-called "noble patina", i.e., cupric and cuprous oxides and, above all, the bronze alloy itself.
The laborious experimental tests necessary to verify the kinetic reactions have forced us also to limit the choice of possible cleaning reagents.
Three different traditional "reactive solutions" are taken in consideration: the neutral and alkaline "Rochelle Salt" and the "EDTA trisodium salt". The behaviour of an ion exchange resin formulation was also examined; the latter

showed an effective action in eliminating surface incrustations on the bronzes.

2 - Kinetics of reactions: experimental part

The formulations examined were the following:

a) RO: a mixture of the following composition (by weight) (pH = 7):

"Rochelle Salt"° (Sodium, Potassium Tartrate)	32.3
micronized silica powder	3.2
distilled water	64.5

b) RA: a mixture of the following composition (by weight) (pH strongly alkaline):

"Rochelle Salt"°	32.3
Sodium hydrate°	7.0
micronized silica powder	3.2
distilled water	57.5

c) ED: a mixture of the following composition (by weight) (pH c.a. 6.5):

E.D.T.A. tetrasodic salt°	13.0
E.D.T.A. disodic salt°	15.1
micronized silica powder	3.2
distilled water	68.7

d) RM: a mixture of the following composition (by weight) (pH c.a. 6):

moist °°°° cation exchange resin°°	19.6
moist °°°° anion exchange resin°°°	31.9
distilled water	48.5

° Merck analytical grade reagents

°° Biorad Dowex 50W-X8 (H^+) resin repeatedly washed with distilled water up to pH 5.5 = constant

°°° Biorad Dowex AG1-X8 (Cl^-) resin converted from chloride (Cl^-) to hydroxil (OH^-) form through repeated treatments with NaOH 1M solutions up to complete removal of Cl^-; then washed with distilled water up to pH 6 = constant

°°°° "moist" intended as a ratio of 140 parts of water/100 parts of resin, by weight

Three materials on which the above mentioned reagents have been tested, were chosen:

a) casting bronze: a granulate about .5 mm diameter was obtained as turning of a bronze alloy free from oxides and other corrosion products.
The composition was the following:

Cu: 83.1% Sn: 5.8% Zn: 6.2% Pb: 3.8%

b) cuprous oxide Cu_2O: prepared by wet synthesis; controlled by X-ray diffraction; ground and collected as 5180 mesh particulate

c) cupric oxide CuO: Riedel de Haën analytical reagent; ground and collected as 5180 mesh particulate

The three materials have been washed, dried and kept in an inert atmosphere up to the moment of reaction.
The kinetic reactions of the twelve possible reactive systems have been carried out in controlled conditions.
To carry out all reactions in conformity with conditions used for RM reagent (an acqueous mixture of resin microspheres) it is necessary to use the other reagents in a paste form obtained by mixing it with an inert micronized silica powder.
Furthermore it was not possible to obtain a flat coherent surface of each of the three materials (bronze, Cu_2O, CuO in a pure state for applications of reagents in compress form. They were therefore used as powders.
As a consequence complications occurred during the separation of the final phases of RM reactions.

250 mg of each of the three materials and 5 g (constituting a strong excess) of each of the four reagents were used for the reactions.
In order to control the kinetics, four times were chosen: 20m; 40m; 90m; 180m, for a total of 48 reactions.
A control (free from reagent solution but only with distilled water) was also carried out for each of the three materials, in the same conditions, for the maximum time of 180m.

The following conditions were chosen:

temperature: 20°C constant during the entire reaction time in a thermostatic bath

reaction room: open text tubes of 10cc were used in order to allow contact with atmospheric Oxygen

mechanical stirring: it was obtained with a glass rod, at periodic intervals of 10 m (systems containing Cu_2O and CuO) and of 5 m (systems containing bronze). The latter shorter time was to compensate the minor specific surface of this material with respect to the others.

interruption of reaction: it constitutes one of the critical steps of the experiment.

RO, RA and ED systems were quickly and strongly diluted at the prefixed times. A separation by centrifugation was then carried out, followed by a quantitative collection of the solution and of five consecutive washing waters.

In the case of RM reactions, the interruption involves a separation between solid phases. In the RM/bronze systems, after a complete elimination of water by centrifugation and washings with acetone, the separation was accomplished using a liquid of intermediary density (CCl_4). Quantitative collection of the resin mixture followed.
The RM/oxides systems were quickly and strongly diluted with water; they were then transferred into a 5180 mesh inert sieve. Oxides particles which did not react were completely washed away with a rapid water flux. (the 5180 mesh sieve, while it guaranties the passing through of oxides particles, does not allow that of resin microspheres).
RO, RA and ED solutions were collected in volumetric flasks and dilute to 50 cc.
Collected RM, after separation from the materials (bronze and oxides) was treated with an 1 : 1 HCl/water solution until complete elimination of the possible fixed ionic copper. The chloride solutions were quantitatively collected in volumetric flasks and diluted to 50 cc.
At the end of programmed reaction times a control was made of end reaction pH.
In all cases no change was found from initial values.
The following are the only observed phenomena during the reaction:

a) <u>RO and RA with Cu_2O</u>: a slight light blue colouring in the acqueous phase with regard to only long time reactions.
b) <u>ED with Cu_2O</u>: medium and intense blue colouring in the acqueous phase in all the reactions; stronger colour intensity for the long time reactions and progressive darkening (from red to brown) in the Cu_2O, especially on the surface.
c) <u>RM with Cu_2O</u>: a more or less intense greenish colouring of resin microspheres and darkening of the Cu_2O. During the regeneration of the resin with HCl, the chloride solutions came out more or less yellow.

3 - <u>Quantitative evaluation of reaction products</u>

For the quantitative determination of the copper in the reaction solution, atomic absorption spectrophotometry was used.

Analytical results expressed as weight percentage of materials (bronze, Cu_2O, CuO) solubilized by the four reagents formulations at various times, are shown in table 1 and in the graph in fig.1.

	times	Bronze	Cu_2O	CuO
RO	20'	< .1	.3	< .1
	40'	< .1	.4	< .1
	90'	< .1	.3	< .1
	180'	< .1	.4	< .1
RA	20'	< .1	.4	< .1
	40'	< .1	.4	< .1
	90'	< .1	.4	< .1
	180'	< .1	.4	< .1
ED	20'	< .1	2.0	< .1
	40'	< .1	5.0	< .1
	90'	< .1	12.5	< .1
	180'	< .1	23.0	.1
RM	20'	< .1	9.2	.6
	40'	< .1	14.4	.6
	90'	< .1	19.4	1.0
	180'	< .1	19.8	1.3

Tab.1 - Percentage values of materials solubilized by the reagent solutions

4. Conclusions

Analytical results confirm that none of the four controlle reagents would attack the bronze alloy in the considered periods of time, for a quantity superior to 1‰; such a value gives a remarkable safety.
With regard to the oxides, a more consistent attack of the reagents, especially towards cuprous oxide, has been ob-

served.
Neutral and alkaline Rochelle Salt works to such a minimal extent that it is negligible, and above all it is not progressive with time towards cuprous oxide; no action, on the other hand was found with regard to cupric oxide.
The E.D.T.A. formulation was also almost inert towards CuO, but showed a notable aggression towards Cu_2O.
Finally, the formulation of mixed bed ion exchange resins appears the most aggressive reagent both in respect to Cu_2O (which it attacks in a marked way also in short periods of time) as well as to CuO.
This study, that consists in only a preliminary approach to the problem, showed that Potassium Sodium Tartrate formulations either alone or alkali additionated do not solubilize the copper present in the metal alloy (bronze) and do not attack the Copper Oxides which are still present in the patina.
Therefore we may conclude that this reagent can be used with complete effectiveness and safety for the cleaning of gilded bronze.
On the other hand, with regard to non gilded bronze, it remains to verify its inertia towards the other components of the old patina, especially towards copper carbonates.

Aknowledgements
The authors wish to thank the "Soprintendenza Archeologica per la Toscana" and in particular Dr.P.R. Del Francia and Mr M. Miccio, for their important collaboration in carrying out all the quantitative spectrophotometric analyses.

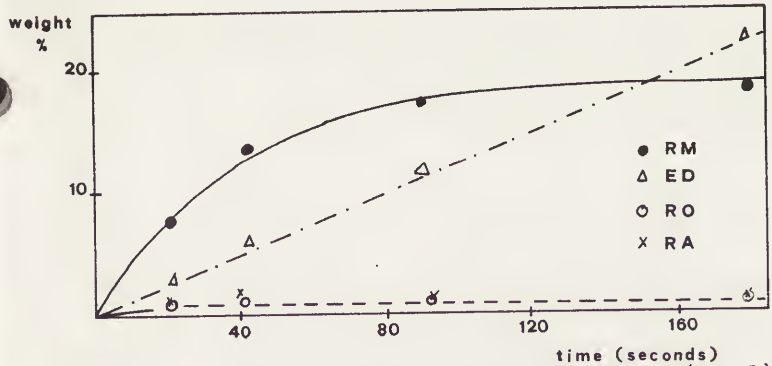


Fig.1 - Weight percentage of material (Cu_2O) solubilized at various times

81/23/5

ON CORROSION IN IRON

James Argo

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Metals

ON CORROSION IN IRON

James Argo

The Canadian Conservation Institute
Conservation Research Services
Conservation Processes Research
1030 Innes Road
Ottawa, Ontario K1A OM8
Canada

Abstract

Corrosion products in marine iron have been identified as iron oxyhydroxides and oxides. The principal species is akaganeite. Tannic acid used to treat iron without further acidification permit the formation of a two phase film. Acidification to pH2.0 leaves single phase films with no trace of corrosion products.

This investigation of the corrosion products in marine iron began by examining the findings of North and Pearson, with the intention of repeating and confirming their results. Using iron from a 16th Century Basque Whaling settlement at Red Bay, Labrador, and from a 19th Century shipwreck off Grand Mannan Island, New Brunswick, we sampled the corrosion layer and analyzed it using Co Kα x-ray diffraction.

The corrosion products found include, goethite, akaganeite lepidocrocite, hematite and magnetite. The first three are hydrated ferric oxides, denoted by the Greek letters α,β,γ and of a chemical formula $Fe_2O_3 \cdot H_2O$. A structural formula is more revealing and we shall henceforth refer to them by the equivalent formulation, the ferric oxyhydroxide, FeOOH. The latter two corrosion products are the familiar red ferric oxide Fe_2O_3 and the black magnetic Fe_3O_4. We have synthesized ferric oxychloride to prepare diffraction standards but have found no trace, in over two hundred analyses, of this material occurring naturally in the corrosion layer, contrary to the results of North and Pearson.

We have subjected the synthetic iron oxychloride to mild hydrolysis using the alkaline sulfite treatment proposed by North and Pearson, and find it converts totally to akaganeite within several days. The extent of the conversion varies directly with the temperature of the hydrolysis. This was first observed by Kratky and later by Keller. Akaganeite is reported in the rust layers of steel exposed to a marine environment, in 4th Century B.C. iron artifacts where its presence was associated with actively corroding sites, and in modern ferrous metals exposed to chloride. It has only been found to form in chloride-rich environments and incorporates the chloride ion randomly into the lattice.

The diffraction lines for akaganeite and ferric oxychloride, when compared, show many close similarities especially in the low d value lines. The two patterns are easily distinguished by the higher value lines at d = 7.40 & 5.25 for akaganeite, and d = 8.0 for iron oxychloride. North and Pearson do not report lines above d = 4.15.

After identifying the corrosion products in iron, we have turned our attention to a detailed study of the processes used by conservators, in an attempt to determine the optimum conditions for treatment. One process studied in depth is that using tannic acid. We initially prepared 0.1 to 10.0% aqueous solutions using Fisher A·310 tannic acid without further purification. A 5ml aliquot of the above solution was allowed to react with the substrate, which was one of the synthetic ferric oxyhydroxides. Each substrate was examined alone, in as pure a form as possible, as well as in combination with others while in contact with the tannic acid.

When the substrate was pure goethite less than one quarter reacted with the tannic acid in its most concentrated form. This is consistent with the comparative stability of goethite and indicates that tannic acid alone cannot be used to treat goethite.

When the substrate was pure akaganeite or lepidocrocite, or mixtures of all three substrates, the characteristic blue-black solution formed. Careful x-ray analysis of the crystals formed, using Co Kα radiation, showed only the lines corresponding to the substrate used. No lines attributable to the complex tannate could be resolved. Further instrumental analysis confirmed that a charge transfer complex is formed between ferric ion and the tannic acid. The continued presence of corrosion products after treatment led to a microscopic examination of the tannic acid-iron complex.

Thin films of iron-tannic acid complex were produced by digesting the corrosion product with tannic acid either at its natural pH, 3.4 - 4.0, or acidified with phosphoric acid at pH 2.0. After filtration to remove the solid, and standing a further 24 hours, to allow the film to form, a microscope slide drawn upwards through the liquid picked up a thin film from the surface of the liquid. Following air drying, the film was examined by light and scanning electron microscopy.

The film prepared at pH 3.4 very clearly showed under crossed polars, the existence of a two-phase system. Using scanning electron microscopy, a map of iron, (the distribution) was prepared for the same region. This showed a uniform background, (the iron complexed in the tannic acid film), with several regions containing approximately ten times more iron, at precisely those locations which were observed to be due to the second phase with the light microscope. The correspondence allows the conclusion that these localised concentrations are the unreacted corrosion products observed with x-ray diffraction.

The film prepared at pH 2.0 shows a uniform distribution of iron as above (the iron-tannic acid complex), with no evidence of a second phase forming. This is consistent with the hypothesis that the extra acid solubilises the iron corrosion remaining which is stabilised by chelation with both the tannic acid and phosphate ion.

Our conclusions may be summarised as follows:

The corrosion layer in marine artifacts consists of goethite, akaganeite, lepidocrocite, (iron oxyhydroxides) hematite and magnetite. No trace of iron-oxychloride has been found.

Tannic acid used at pH 3.4-4.0 to treat corrosion will permit unreacted corrosion products to remain on the artifact forming a two-phase system from which corrosion may begin again.

Tannic acid acidified to pH 2.0 with phosphoric acid will produce a uniform single phase system with no corrosion products retained.

Tannic acid cannot be used alone to treat pure goethite.

81/23/6

INHIBITED H_2SO_4 AND HCL STRIPPING SOLUTIONS FOR IRON

P.T.Wilthew

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Metals

INHIBITED H_2SO_4 AND HCL STRIPPING SOLUTIONS FOR IRON

P.T.Wilthew

Conservation and Technical Services Department
British Museum
London
Great Britain

Abstract

Hydrogen evolution and stripping of corrosion products from mild steel in 1M sulphuric acid and 1M hydrochloric acid in the presence of various inhibitors at various concentrations has been studied. These solutions have been compared to 0.5M, 1M and 2M citric acid and orthophosphoric acid solutions, 1M sulphuric acid inhibited with thiourea or benzotriazole was found to be slightly superior to citric acid solutions. Orthophosphoric acid solutions were more corrosive. The results suggested that inhibited 1M sulphuric acid could provide an alternative to citric acid for stripping corrosion products from iron objects in certain situations.

Introduction

Acid pickling or stripping solutions, usually based on hydrochloric acid or hot sulphuric acid, are commonly used in industry to remove corrosion products from steel. Low concentrations of organic compounds, known as pickling or acid corrosion inhibitors, are added to reduce the corrosion rate of the base metal during stripping. It has been proposed by corrosion chemists that inhibited sulphuric acid or hydrochloric acid solutions could be used in conservation to remove rust from iron objects. Inhibited sulphuric acid or hydrochloric acid solutions might provide an alternative to the citric acid or phosphoric acid based solutions more often used in conservation in situations where mechanical stripping methods are not practical.

A vast literature exists concerning the inhibition of iron corrosion in sulphuric acid and hydrochloric acid solutions by organic compounds, and several lists of possible inhibitors have been published (1, 2). Two important groups of inhibitors for sulphuric acid solutions are compounds derived from thiourea (3, 4), and benzotriazole (5, 6). Hexamine (7), triphenylphosphine and thiourea

(3, 8) derivat : been suggested as inhibitors of iron corrosion in h ric acid solutions.

No generally acc mechanisms for either inhibition by organic compounds or rust stripping in acid solutions have been proposed. In most cases effective inhibition requires adsorption of inhibitor molecules on the metal surface, usually through a polar N, S or P atom (2, 9). Several mechanisms have been suggested for the stripping of corrosion products from iron. Evans has proposed that the corrosion products are both dissolved and prised from the metal surface by hydrogen bubbles formed when the base metal corrodes (7). Iron corrosion in non-oxidising acids occurs by reactions (a) and (b) below:

$$2H^+ + Fe \longrightarrow Fe^{2+} + 2H^{\cdot} \qquad (a)$$

$$2H^{\cdot} \longrightarrow H_2 \qquad (b)$$

In the present work, stripping solutions based on 1M sulphuric acid, inhibited with thiourea, benzotriazole, thiosemicarbazide and hexamine, and 1M hydrochloric acid, inhibited with hexamine and triphenylphosphine, have been studied. The solutions have been compared to 0.5M, 1M and 2M citric acid and orthophosphoric acid solutions. The corrosion rate of mild steel and the rate of rust stripping in the solutions has been assessed in each case.

Experimental

1. Materials

All tests were carried out on specimens cut from a corroded mild steel chain. All cut ends were coated in resin.

The chemicals used where:

Benzotriazole (Laboratory Reagent)

Hexamine (Hexamethylene tetramine) (Assay: 99% min)

Thiosemicarbazide (Laboratory Reagent)

Thiourea (Assay: 99% min)

Triphenylphosphine (Assay: 98% min)

Citric Acid Powder (Assay: 99.5% min)

Hydrochloric Acid (Assay: about 36%)

Orthophosphoric Acid (Assay: 88% min)

Sulphuric Acid (Assay: 97.0 to 99.5%)

Distilled Water

2. Method

The compositions of all test solutions are given in table 1 below. All sulphuric acid, hydrochloric acid and orthophosphoric acid solutions except solution 15 were prepared individually by diluting the appropriate acid in distilled water and then dissolving the inhibitor in the dilute acid solution. Solution 15 was prepared by dissolving triphenylphosphine in concentrated hydrochloric acid. The concentrated acid was then diluted in distilled water to give a saturated triphenylphosphine solution and a fine precipitate of triphenylphosphine. Hydrogen was bubbled through the solutions for at least 24 hours to minimise errors due to the solubility of hydrogen in the solutions.

The nominal surface area of each specimen was calculated before stripping by assuming them to be smooth rods of circular cross-section.

The tests were carried out by immersing the specimens in the test solutions for periods of up to 150 hours. The corrosion of base metal was studied by following the evolution of hydrogen during the tests. The hydrogen evolved in each test was collected above the solution in a burette. The time to complete stripping was determined visually.

A plot of volume of hydrogen evolved per unit nominal area against time was obtained. The readings were corrected to 273K ($0^{o}C$) but no attempt was made to allow for the solubility of hydrogen in the base metal. Results obtained in terms of volumes of hydrogen were converted to the weight loss results quoted below by assuming all hydrogen evolution to have been by reactions (a) and (b).

Tests were carried out at 291K ($18^{o}C$).

Results and Discussion

The results obtained for each solution tested are given in table 1. The parameters quoted in table 1 were defined as follows:

ts = time required for complete removal of rust as determined visually.

R = rate of corrosion at time ts.

$$I = \frac{(Ro - Ri)}{Ro} \times 100 = \text{percentage inhibition}$$

where Ri = corrosion rate in the inhibited solution.

Ro = corrosion rate in the corresponding solution without inhibitor.

Test	Acid	Inhibitor	ts (h)± 10	R($gm^{-2}h^{-1}$)	I (%)
1	1M H_2SO_4	None	20	29	0
2	"	1.10^{-3}M Benzotriazole	40	16	45
3	"	3.10^{-3}M Benzotriazole	60	7.3	75
4	"	1.10^{-2}M Benzotriazole	70	2.0	93
5	"	3.10^{-2}M Benzotriazole	60	1.6	94
6	"	1.10^{-3}M Thiourea	50	10.1	65
7	"	3.10^{-3}M "	50	2.7	91
8	"	1.10^{-2}M "	60	1.6	94
9	"	3.10^{-2}M "	50	2.0	93
10	"	1.10^{-1}M "	40	8.7	70
11	"	1.10^{-2}M Thiosemicarbazide	70	1.5	95
12	"	1.10^{-2}M Hexamine	70	2.7	91
13	1M HCL	None	20	15.8	0
14	"	1.10^{-2}M Hexamine	70	2.7	83
15	"	Triphenylphosphine	70	2.2	86
16	0.5M Citric	None	100 ± 20	1.2	0
17	1M Citric	None	90 ± 20	2.6	0
18	2M Citric	None	70	3.4	0
19	1M H_3PO_4	None	40	6.0	0
20	1M H_3PO_4	None	30	11.6	0
21	2M H_3PO_4	None	15 ± 5	16.9	0

Table 1: Stripping rate, corrosion rate and percentage inhibition obtained with each stripping solution.

Although mild steel is corroded rapidly by both 1M sulphuric acid and 1M hydrochloric acid, the corrosion rate was substantially reduced by all the inhibitors used. The most effective inhibition was obtained using thiourea (94%), thiosemicarbazide (95%) and benzotriazole (94%) in 1M sulphuric acid. As the stripping rate was similar in each inhibited solution, 1M sulphuric acid solutions inhibited with thiourea or benzotriazole, both relatively easily available compounds, appeared to provide the most promising stripping solutions.

The effect of thiourea and benzotriazole concentration on corrosion rate is shown in Figure 1. Benzotriazole was an effective corrosion inhibitor at both 1.10^{-2}M and 3.10^{-2}M concentration. The corrosion rate decreased only slightly with inhibitor concentration above 1.10^{-2}M, and this would appear to be a suitable concentration to add to a 1M sulphuric acid stripping solution.

Thiourea was effective at concentrations of between 3.10^{-3}M and 3.10^{-2}M. A thiourea concentration within this range should inhibit a 1M sulphuric acid stripping solution adequately. Excessive concentrations of thiourea should not be used, as it is not an effective inhibitor at high concentrations, or at elevated temperatures. (3)

The inhibited solutions described above behaved in a manner comparable to that of the citric acid solutions. The 0.5M citric acid solution corroded at a slower rate (1.2 $gm^{-2}h^{-1}$) than the best inhibited solution (1.5 $gm^{-2}h^{-1}$), but the stripping time required was greater in 0.5M citric acid. 1M and 2M citric acid solutions corroded faster than the inhibited solutions and required slightly longer stripping times.

0.5M, 1M and 2M orthophosphoric acid corroded mild steel very much faster than either 1M sulphuric acid, inhibited with thiourea or benzotriazole, or the citric acid solutions. Stripping in orthophosphoric acid solutions was found to result in greater total corrosion of the specimen and was less controllable than stripping in either citric acid or 1M sulphuric acid inhibited with thiourea or benzotriazole.

The behaviour of inhibitors depends on the conditions at the metal/liquid interface, which are influenced by metal composition and structure. Wrought iron and carbon steels would be expected to behave similarly to mild steel with respect to an inhibited acid solution, unless a high concentration of an impurity such as sulphur or phosphorus is present in the metal. Considerable care should be taken if an inhibited acid stripping solution is used on cast iron objects. Inhibited acid stripping solutions are not suitable for use on composite or inlayed objects. Iron objects should never be placed in an acid bath which has previously contained any copper object, as copper may be deposited on the surface of the iron object. The acid solutions considered in this work all removed the

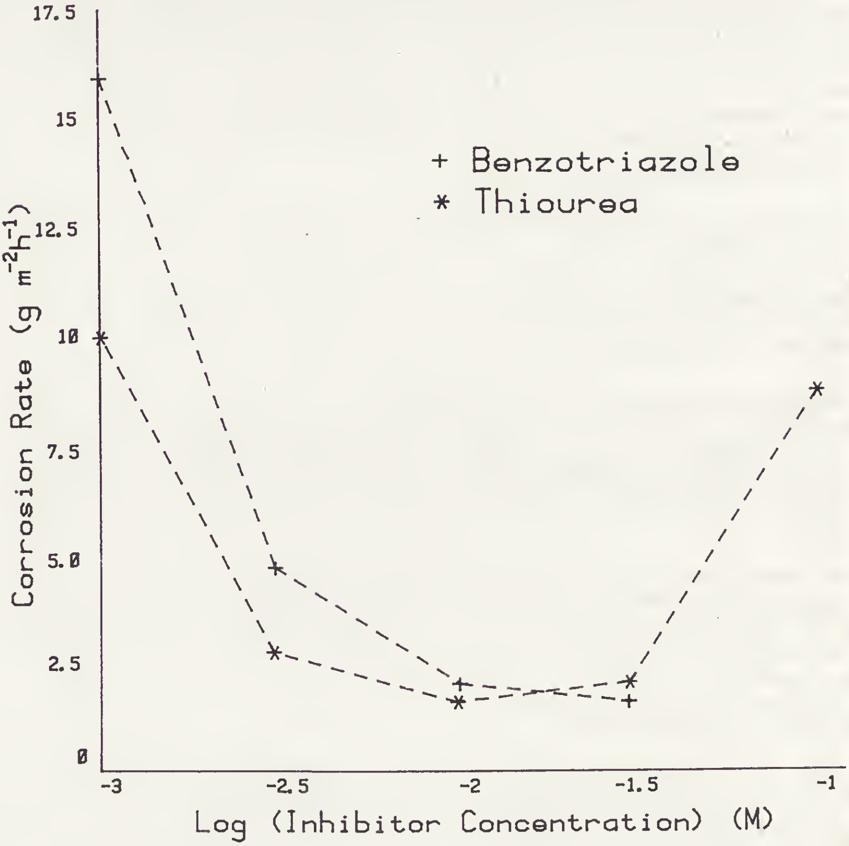


Figure 1: Effect of thiourea and benzotriazole concentration on the corrosion rate of mild steel in 1M H_2SO_4.

entire rust layer from the specimen and caused some corrosion of the specimen. They are not suitable for use in situations where complete removal of the rust layer is not desired, or where slight loss of base metal is not acceptable.

1M sulphuric acid solutions inhibited with thiourea or benzotriazole do provide alternatives to citric acid and orthophosphoric acid solutions. Their properties were found to be superior to those of citric acid solutions, and considerably better than those of orthophosphoric acid solutions. The potential dangers associated with inhibited sulphuric acid solutions are however greater. If an unsuitable inhibitor concentration is used or if the inhibitor is not effective in a particular case, very rapid corrosion of an object will occur. Stripping in sulphuric acid or hydrochloric acid solutions should be observed carefully, particularly in the early stages, to ensure that no area of the object is corroded excessively. Localised corrosion may result in serious damage to an object even if the total loss of metal is small. It is not safe to vary the inhibitor or acid concentration of an inhibited sulphuric acid or hydrochloric acid solution significantly without ensuring that the new solution is adequately inhibited.

After stripping in hydrochloric acid or sulphuric acid, thorough washing of the object must be carried out to remove all traces of acid. If any acid remains on the object, it may subsequently result in serious localised corrosion. It has been suggested that this problem can be avoided by dipping the object in a hot phosphoric acid bath for a short period (7). Iron phosphate is a white grey compound which is insoluble in water, and will therefore help to passivate iron against further corrosion.

Conclusions

Mild steel corrosion in 1M sulphuric acid can be inhibited effectively by thiosemicarbazide, thiourea, benzotriazole and hexamine in suitable concentrations. Mild steel corrosion in 1M hydrochloric acid can be inhibited by hexamine and triphenylphosphine. The most appropriate solutions for use in conservation are 1M sulphuric acid inhibited with thiourea (3.10^{-3}M - 3.10^{2}M) or benzotriazole (above 1.10^{-2}M). These solutions are slightly superior to 0.5M - 2M citric acid, and 0.5M orthophosphoric acid corrodes mild steel considerately more rapidly. The stripping rate was similar in each inhibited solution and was slightly faster than the rate in citric acid, but was slower than the rate in orthophosphoric acid.

Inhibited 1M sulphuric acid stripping solutions provide an economical alternative to citric acid or orthophosphoric acid based solutions for use in conservation. However the potential dangers of 1M sulphuric acid are greater. Stripping must be carefully observed to ensure excessive corrosion is not occurring, even in a restricted area of the object. All traces of sulphuric acid or hydrochloric acid must be removed after stripping. Residual sulphate or chloride could subsequently cause serious localised corrosion.

Acknowledgement

The author would like to acknowledge Dr. D. Barker of Portsmouth Polytechnic for his valuable help and advice.

References

1. G.G. Eldredge and J.C. Warner, In Corrosion Handbook (Ed. H.H. Uhlig) p.905. Wiley, N.Y. (1948).

2. G. Trabanelli and V. Carassiti, In Advances in Corrosion Science and Technology (Eds. M.G. Fontana and R.W. Staehle), Vol.1, p.147. Plenum Press, N.Y. (1970).

3. M.N. Desai, G.H. Thanki and M.H. Gandhi, Anti-Corrosion, p.12, July (1968).

4. B.G. Ateya, B.M. Abo-Elkhair and I.A. Abdel-Hamid, Corrosion Science, Vol.16, p.163 (1976).

5. N. Eldakar and K. Nobe, Corrosion, Vol.33, No.4, p.128, April (1977).

6. N. Eldakar and K. Nobe, Corrosion, Vol.32, No.6, p.238, June (1976).

7. U.R. Evans, In The Corrosion and Oxidation of Metals, Edward Arnold (1960).

8. B. Donnelly, T.C. Downie, R. Grzeskowiak, H.R. Hamburg and D. Short, Corrosion Science, Vol.14, p.597 (1974).

9. U.R. Evans, In The Corrosion and Oxidation of Metals, Supplement Two, Edward Arnold (1976).

81/23/7

RESTORATION OF THE CRUCIFIX CLOCK OF THE ESTERHAZY-TREASURY FROM THE 17TH CENTURY

Jenö Rácz

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Metals

RESTORATION OF THE CRUCIFIX CLOCK OF THE ESTERHAZY-TREASURY FROM THE 17TH CENTURY

Jenö Rácz

Iparmüvészeti Muzeum
Museum of Decorative Arts
Hungary

The seriously damaged clock was made in Pozsony, in the thirties or forties of the 17. century.

The time is shown by the movement of Roman numerals chiselled into a ball rotating behind a standing hand.

The wooden parts of the clock are made of black stained nutwood. The figure of Christ, the skull and shin-bones placed at the foot of the crucifix as well as the ball-like feet were made of bronze. The clock work was hammered of yellow brass, the springs and axels were prepared of blued steel. After alcoholic cleaning the restorer glued the wooden parts with UHU-plus adhesive. The gaps on the base were completed in conformity with the original with nut-wood. Christ's missing left-hand was filed of bronze. Having been soldered, it was gilded on the discoloured surface. The copper parts were purified with Argentol, the steel-parts mechanically. The broken or lost pieces were completed by the author. The restoration ended with the assembling and adjustment of the clock work.

The National Museum of Applied Arts takes care of the very important collection of works of art recorded by the name of "Esterházy-treasury" in the home and foreign special literature. During the 2nd World War the house guarding the collection was hit by a bomb and the material of the works of art was covered with the ruins of the building for 4 years. A great part of these objects, among them the crucifix in question, was seriously damaged by the explosion of the bomb as well as by the weight of the fallen masonry and the effects of the rainfall and soil corrosion.

The material of the crucifix once sawn, dowelled and stuck together of two parts split in 14 pieces. There were chips and cracks on it in several places. Its upper piece with the clock ball was built together with the corrosion products of the iron stem going along the stand and was deformed. The inner surface of the numeral ring was covered with green basic carbonates. It was organically corroded together with the above mentioned clock ball. The exterior was soiled only in spots, while the other half of the ball came to light clean. The top was ended in a figur of baluster form, which had a bent and cracked support. Also the corpus was full of earth soilings and corrosion efflorescences. The link hand, with the exception of the thumb, was broken and lost. The skull and shin-bones fixed to the foot of the crucifix came into the museum in good preservation.

After having done photographing and mechanical cleaning, I carried out also the lifting out of the clock work. This was followed by flushing the clock work in benzine.

I have also found the clockmaker's name and the place of the making written on the bottom plate. The clockmaker was Isaac EBHERT and the place of making PRESBURG.

On the basis of the style of our clock (architectonic elements formed with saw and profile plane and by carving) it represents the early Baroque taste. The form of the ends of the cross is lily-like. The clock is, owing to its structural building-up, one of the smaller ones (it is hardly bigger as the clocks of the first half of the 17 century which could be carried round the neck)[1]. The making of the clock may be dated to the thirties or forties of the 17. century.

<u>Cleaning, glueing, complementing of the wooden parts, protection of substance</u>

The cleaning was carried out with 70% ethylalcohol and cotton-wool and the glueing was made with UHU-plus epoxy resin adhesive. During the operations it appeared that the silvering of the bottom-plate and the numeral ring were stronghly tarnished and became defectuous.

I was able to start planishing the cleaned bottom-plate only after the removal of the riveted feet. This was carried out on a polished steel block using a leathered hammer in order to avoid that traces of tools remain on the surface. The lock of the small door on the bottom-plate was also repaired, then the feet were fixed to their old place again.

Thereafter I examined the surface on the figure of Christ in order to determine the technique of its making. On the basis of the holes on the head and the back of the body as well as from the way of processing one could conclude that it was made using the hollow casting of wax liquefaction, but on the strength of the evidence of the ugly traces of jointings the arms were soldered to the body afterwards. The axle of the core made supposedly of clayey sand or plastery brick-dust broke through the material of the cast on the top of the head turned on one side and in the bottom region. As one could not remove the great core axle from the head during the processing, its end was filed down. From this we could determine that it was made of iron. The other small holes guard the places of the needles and rods fixing the core, although the masters used to mend them with greater care than in our case. The preparation and modelling of the wax mould is, however, very fine and show a good sense for plastic art and a great sculptural experience.

The solution of the preparation of the hand and fingers is particular. They were not formed by moulding a modell but by filing out the material soldered into an opening incised in form of V.

Considering that the fingers of the left-hand were lost as a consequence of the splitting of the soldering caused by the hit, their complementing needed to be made in conformity with the other hand. A break was spread across the upper leg of the corpus and in the rear over the shawl. I did not find necessary to solder it, so much the more that the gilding might loose its colour by this. I was forced to regild the discolouration by galvanic way which was already experienced during the complementing of the left-hand and which could not be avoided not even with the localization of the soldering flame (similarly also when soldering the baluster support fixing the clock ball).

The regeneration of the discoloured gilding and silvering (only on the concerned surfaces) was carried out in a cyanic bath, then after having reached the required hue, they were rinsed and dried and the surfaces were polished with burnishing agate.[2]

The cleaning of the skull soldered to the shin-bones at the foot of the cross caused no problems. In connection with its preparation it must be noted, however, that the making of the cast surface of the face and similarly the finishing of the flashed surfaces formed of sheets and flushed of the rear part is very poor and superficial. All these indicate that their master might be someone else as the clockmaker.

Supplementing of the missing and chipped wooden parts

The continuity of the model could be determined in all cases and its form, due to the symmetrical fashioning, offered itself unambiguously. The gaps were completed in conformity with the basic material using nut-wood and the glueing was carried out in the above-mentioned way with UHU-plus adhesive. After the hardening of the synthetic resin the shaping of the supplemented parts was made with fine chisels, knives and files. I made efforts for flattening the smaller indentions using a warm iron, but in the cases when this did not succeed, I omitted to "flush" them with synthetic resin or by building in wood. Similarly I did not supplement or mend the originally missed carvings, the defects of filing and the chips. (For the reason of these defects including also those of the shaping of the goldsmith's work I think it imaginable that these parts were not made by a special technician but by one of the journeymen working by the clock-maker.) I drew the gaps of the sawn sarmentum motive adorning the middle field of the box sides on the base of the well discernible spots on the cleaned base surface (which remained clear during the staining of the pattern stuck on it), then they were fret-sawn. The assembling and sticking was executed on the box in such a way that small paper slices were cut under the part to be stuck preventing the adhesive from binding to the base by this means.

After the spatial meshing of the synthetic resin had been developed, I took off the pattern, flushed the eventual differences in level, then after having carved the decorative row (of eggs and balls) missing from the short sides of the box I stuck all the elements in place with the help of instantaneous clamps, underlays and counterforms.[3]

Protection, staining and polishing of the wooden material

After having built together the wooden construction (box, lid, cross, cover-plate of the channel running along the rear side of the cross) and in order to protect it from the eventual damages done by insects and from the fungue contamination, I treated the wood with a 2% solution of penta-chlor-phenol (dissolved in industrial alcohol).

After several days I removed the fine dust-like crystals of the unabsorbed chemical, then I darkened the supplemented and therefore clear wooden parts to the required hue with nut-stain. The surface, which became erect after staining (as the fibres on the surface of the complements stood on end under the effect of the moisture), was finally smoothed, thereafter polished with the help of a varnishing ball[4]. The restoration of the wooden parts ended with this.

Cleaning of the metal material not belonging to the clock-work

The moulded elements were made of gilded or silvered bronze, the plate-work was produced of brass beaten out with hammer.[5] Before cleaning I removed the broken and rusted remains of the fixing screws mechanically, then they were treated in Argentol. I applied a "polishing" with (semiwet) bicarbonate of soda, which, according to my experiences, gives an adequate brilliance to the surfaces and accomplishes also the perfect neutralization of the acidic purifying agent. Thereafter the objects were boiled out in distilled water and dried.

Iron screws

Among all the blued nails driven into the hands and feet (in this case picked screws) only one remained. All the other screws needed to be supplemented by preparing new pieces, respectively by transforming them and to be blued.

In the last phase of the work the cleaning and repairing of the clock-work followed.

Establishment of the defects (still in mounted state)

The clock-work previously cleaned in benzene showed the following defects and damages:

Front side: The four brass screws on the four corners keeping the right distance of the clock-work inside the box were broken at the neck. The stem of the clock-hand (a long iron rod) was broken in two and rusted in several places. The spring operating the striking hammer was split in two. The heads of the screws were rusted.

Rear side (decorative surface): The movement of the swing-wheel was hindered. The surface of the winding mandrel, the striking hammer and the arms fixing the construction were rusted in many places, the toucher disc stopped between the sixth and seventh striking zones.

Inside of the construction: The brass barrels became green in some places (copper carbonate), the wheels were intact. The blued steel surfaces showed punctiform corrosion centres.

Dismantling, repairing, cleaning

Before dismantling I made relax totally the springs in order to protect the clock-work against the damages, which might be caused by the suddenly released forces during the taking out. First the hand-axle and the escape-wheel[6] with the plate-spring[7], the fixing-wheel disc, then the sarmentum decorated guard-plate (bridge) of the swing-wheel were dismantled. Thereafter the swing-spindle was lifted out, the movement of which was caused by the breaking off of the moment raising lead segment stuck to the balance wreath with sealing-wax. It was possible to stick it again on place by warming up the old wax (with a hot blade of knife). I chose intentionally no other stronger adhesive so that we could guard this peculiar solution. The one of the stems of the pig' bristle placed on the guide-arm was broken, its replacement was justified for the sake of the later regulabliness.

After the removal of the toucher-arm on the decorative side, the disc, the wheel and ornament mounted on the winding-mandrel, the escape-arm of the striking-work[8], as well as of the clasping bolts placed on the small columns in the corners, the upper plate could be taken down. I lifted out cautiously the axles of the cog-wheels from the pin-borings and the whole construction was dismantled to its elements. I examined the wheels with a magnifier and could find out that they were run down only in a small degree what indicates that they were effectively used only for a short time. The copper surfaces were cleaned in Argentol, the steel screws and blued wheel-axles only mechanically with the help of fine silicon-carbide paper (of grain-fineness of 600), then they were polished so that the blueing of the intact surfaces should not be endangered[9]. After cleaning I had to reblue the surfaces of the mountings, axles and screws which were strongly damaged by corrosion. For this I carried out colour tests on a sample of similar size, then by heating the "blueing plate" with mild gas flame (about 300°C) I blued the polished and degreased surfaces put on it one by one.

Before the assembling the spring and the arrester gear[10] were smeared with fine (acid-free) oil[11], then the wheel-work and all the mountings were assembled in an opposite order with that of the dismantling, and the bolts were oiled. The broken spring operating the hammer was softened, then on the basis of the faint outline showing wear traces on the photograph taken after the previous cleaning the lost part of the spring was prepared. For ensuring an adequate overlapping the supplement was cut a little longer and the parts were fastened together with the help of 4 tiny rivets.

The bent and broken middle part of the hand-stem, which became thin from the rust, was replaced by a new material fixed with hard-soldering[12]. After its replacement the clock-work became able to run and it was only the preparing of the lost hand to be done yet.

Adjustment

In the first days the clock set going was very fast, but with the help of the regulator[13] I could make it relatively correct which corresponded to an accuracy of ± 4 minutes in a daily run.

Notes

1. The average dimensions of the clocks, which could be carried round the neck: about 50 x 40 x 30-40 mm.
2. The polishing of the objects of complicated form was carried out in the past - but in certain cases also nowadays - with polishing agate, heliotrope or with steel polishing tools. In the course of the process the small unevennesses of the surface made slippery with soap were spread in plain and "polished" with the above-mentioned tools of different form.
3. Negative form of the carved laths. The pressing down of the sawn patterns of the middle fields was made with wooden-plates covered with felt.
4. The varnishing of the carved edges and sawn patterns was executed by polishing up the shellac solution brushed in a thin layer onto the surface after its drying.
5. Material laminated not by rolling, but by beating flat a poured mass on an anvil with the help of a hammer (its characteristic is the foliated structure of thin layers).
6. Cog-wheel connected with the clock-work, which makes run the movement of the striking work.
7. Three-branched structural element cut of thin brass disc, producing a sliding-stretching connection.
8. Escape-arm = elastic wedge fastened to the rear bolt of the toucher-arm axle, which is operated by the turning away of the escape-wheel.

9. The acid produces a dissolving effect on the thin iron-oxide layer of the blueing.

10. It is constituted of a cog-wheel hindering the winding back of the spring and of a small steel-plate stretched by a spring, which enables a movement only in one direction.

11. It is important that the lubricant may not produce a dissolving, corroding effect on the material of the bolts and axle-ends.

12. A metal-soldering technique using solders of melting temperature above 300°C (silver, brass and copper). In this case was used which melted on 800°C. The flux was borax.

13. Regulator = pig's bristle fixed into the regulating-lever.

ICONS

Coordinator: I.P.Gorine (USSR)

Members : N.G.Bregman (USSR)
R.L.Feller (USA)
E.C.Hulmer (USA)
S. Kolk-Skalova (Netherlands)
D. Kreidl (Austria)
O.V.Lelekova (USSR)
L. Majewski (USA)
P. Meyers (USA)
L. Nikolajevic (Yugoslavia)
E. Pohl (Yugoslavia)
R. Van Schoute (Belgium)
A. Skovran (Yugoslavia)
H. Verougstraete-Marcq (Belgium)

Programme 1978-1981

1. L'enlevement des couches superposées avec leur transposition sur un nouveau support (Lelekova).
2. Contrôle sur le processus de découverte (Bregman).
3. Conservation des icônes (Kreidl).
4. Stabilisation originale et moderne du support (parquetage) (Pohl).
5. Technique d'icônes du 19me siècle et problèmes de restauration (Kolk-Skalova).
6. a) L'aspect esthétique des vernis des icônes (vernis colorés d'après les écoles différentes - confrontation avec les vieilles recettes d'Hermenias)
   b) Le développement de l'iconostase - aspect générale (iconographique)
   (Skovran).
7. Attribution des icônes (Nikolajevic).
8. Supports (et cadres) des icônes Bulgares (Verougstraete-Marcq).
9. Elaboration d'une fiche de documentation idéale (Van Schoute).

81/24/1

ELEMENTS OF THE PRE-CHRISTIAN SYMBOLICS IN THE ICONS OF THE NORTHERN RUSSIA IN THE XIV-XVII CENTURIES

A.A.Rybakov

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Icons

ELEMENTS OF THE PRE-CHRISTIAN SYMBOLICS IN THE ICONS OF THE NORTHERN RUSSIA IN THE XIV-XVII CENTURIES

A.A.Rybakov

Musée -Atelier de Restauration
ul. Krasnoarmeyskaja 35
Vologda 160000
USSR

The Northern Russia's art maintained close and direct relations with profound inner layers of the folk spiritual life. Its Christian imaginative structure was often complicated with motives which were far apart from Christianity and the Christian contents were sometimes vested with the traditional pre-Christian form.

As it is known some Christian saints very popular with the peasantry of the Northern Russia took up the function of the previous pagan idols[1]. Their carved wooden effigies were mounted in the pagan sanctuaries. In the North the cult of St. Nicolas the Miracle Worker and of St. Paraskeva Piatnitsa was especially widespread.St.Nicolas was regarded as the protector of agriculturists, warriers, travellers, the saviour of the people perishing in the waters, the quick intercessor and assistant of all misers and innicent sufferers, his image became the incarnation of the male origin in the enviroment[2]. The female origin was personified with the image of Paraskeva Piatnitsa, the protectress of love, trade and weaving who took up those function from the old Slavonic female divinity Mokosha[3].The sculptural wooden effigies of St.Nicolas and St.Paraskeva widespread in the North were a substitution in a certain way for ancient wooden idols, they inherited their certain artistic particularities - frontality, form undismembership. There were icon images of St.Nicolas and Paraskeva Piatnitsa in many chapels and temples of the Northern Russia. The most early ones from them which were painted by local masters in the XIV - XV centuries are very near in their character to the personages of the wooden plastic art. They are usually in the same way frontal and laconic in the figurative means. Like frosen figures of saints with narrow slanting shoulders, robed in long, straight chasubles they resemble with their pillarlike pose effigies of the ancient heathen plastic art. Such pillar like pose and form lapidarity are also to observe in the figures of selected saints who were painted round the middle part or on the icon margins. In this strictly limited character of the figurative system the echoes of the old pre-Christian attitude to the cult subject as to the saint symbol exist, its direct resemblance to real existing forms was not only necessary but also counter-indicative[5].

The interpretation of the idea about the three part world structure in the Northern Russia icons is of great intrest too. The idea about three worlds - upper one (heaven) middle one (earth) and loner one (under earth) was formed long before the appearance of Christianity and dwelled among many nations. It was known to the Slavonic peoples and also to the Ugro-Finish population of the North[6]. In the Northern Russia painting this idea about three part world is to trace in many a subject, but in the aspect which intrests us most it is in the most vivid form expressed in the icons "The Last Judgement","Resurrection - Descend into Limbo","Fruits of Jesus' Sufferings"and "The Single Son".

According to the Bysantine iconography for the "Last Judgement" three spheres of the world are connected through the fire river which originates at Jesus'throne and drops into Limbo[7]. The Finish-Ugro population of the Kama region in the 1st millenium A.D. was also familiar with the idea about the cosmic river. In some cases this river was painted on Perm.shaman badges as snakes spreading their heads to the sun[8]. On the early Russian paintings of the "Last Judgement" in accordance with the Bysantine examples the cosmic river which took sinners to Limbo was depicted as a fire stream. But on Novgorod and Nothern icons of the "Last Judgement" beginning from the middle of the XV century and up to the end of the XVII century the image of the huge serpent appears It soars up to Jesus' throne and takes sinners down to Hell[9]. In the Russian North the old symbol of the serpent - the inhabitant of the underearth reign - seemes to revive.

On the icons that represent "Desent into Limbo","Fruits of Jesus' Sufferings" and "The single sun" we are to reencoun ter the picture of the three-part world. In the XVI century the Bysantine composition scheme of the "Desent into Limbo" in the Russian North art Kept on complicating and assembling new personages. Among them quite sudden the symbolic figure of the terrible lord of the underearth reign - the enormous pangolin with the long teeth in the mouth which devours sinners - emerges. It is distinguished through the red paint on the dark hack ground of the aperture of the Limbo abyss in the lower part of the composition[10]. The pangolin image as a symbol of the underearth world is often to see on the art objects of the Perm animal style in the VII - X centuries.It also occupies the lower part of the composition[11]. Among northern icon paintings of the XVII century in accordance with the common trend of the barocco style to the hyperbolisation the monster mouth acquires more terrible dimensions and occupies the right, sometimes the left part of the side which represents the underearth world.

The scene of sinners swallowed by the pangolin with the same purpose of frightening the sinners with the inevitability of their eternal ruinition was included in the XVII century in the composition schemes of the icons "The single Son" and "Fruits of Jesus' sufferings", and they reflected the folk cosmogonic ideas of that time.

The researchers often note the fact of the particularly wide spreading in the North in the XIV - XVII centuries of icons with the image of St.Georg the Victor riding the horse and killing the dragon[12]. Although the subject and the composition basis of its figurative solution came to Russia via Bysantine from the East the development of its iconography in numerous variations and its unusual popularity in the Russian North cannot be recognized as casual.

According to its symbolic significance the scene of struggle - St.George on horseback against the dragon - interprets the eternal theme of struggle of Good against Evil; Light against Darkness,Life against Death which are the basis of religion and arts among many if not among all nations of the world in all times and which founed its expression in numerous forms. The particular popularity of the "St.George's Miracle against the Serpent" in the Middle Age Northern Rus can be explained only with the following argumentation - in this case the artistic incarnation of the victory idea of

Good against Evil was expressed symbolically through sign images that were known of yore to the local population. The horse cult, the cult of a true friend and an assistant to the human being the image of which had a magic preservation significance existed among slavonic and Ugro-Finnish tribes,[14] its echoes are to find up to the present in the Russian North. As for the Serpent-Dragon which personifies the dark forces of the underearth world this personage as was mentioned above was the principal one in the ideas of the local population about the reign of the Death and evidently not casually the Serpent was often painted with the long muzzle and the pangolin mouth with sharp teeth, vague reminiscences about the pangolin were preserved somewhere in the depth of the folk memory.

The above mentioned elements of the pre-Christian symbolics in the painting of the Russian North are very demonstrative, but they do not exhaust in the long run the whole of richness and versatility of connections between the art of the Russian North and great cultures of Old Times, in the first line with artistic traditions of old slavonic and Ugro-Finnish peoples. Their fuller and more accurate research is the task for the future.

81/24/2

CERTAIN TECHNICAL AND TECHNOLOGICAL CHARACTERISTICS OF ICONS IN NORTH RUSSIA IN THE XIV-XVIII CENTURIES

A.A.Rybakov

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Icons

CERTAIN TECHNICAL AND TECHNOLOGICAL CHARACTERISTICS OF ICONS IN NORTH RUSSIA IN THE XIV-XVIII CENTURIES

A.A.Rybakov

Musée - Atelier de Restauration
ul. Krasnoarmeyskaja 35
Vologda 160000
USSR

In the course of restoring and investigating tempera easel paintings of the XIV-XVIII centuries, whose origin was North Russia, one can notice that the manner of their execution and the choice of the material used for them have some peculiar features, which distinguishes them from ancient paintings in other parts of Old Russia.

Support (panel). In the forests of North Russia conifers predominate, and thus they served there as the main building material. The support for northern icons in the XIV-th and the beginning of the XV-th centuries was made mainly of pinewood boards (panels). The panels were cut with are and adze and sometimes they were trimmed with spoke-shave. Their butt-ends were also chopped off with axe, and as a result they always have characteristic notches and uneven surface. As a rule, the XIV-th century icons were painted on thinner panels than those of the later periods of time; their thickness varies from 18 mm to 30 mm according to their width and height. At the end of the XV-XVI centuries in the southern parts of North Russia the custom of painting icons on lime-tree panels became popular as a result of the growing influence of

Moscow artistic traditions. In the XVI-XVII centuries the thickness of panels gradually increased, and by the end of the XVII-th century it reached sometimes 60 mm.

With verg few exceptions the composition of icons was in the kovcheg - a small depression on the face of the panel, in which the margins above the depression formed something that looked like a frame. In old times separate parts of the panel were glued together and fastened with butt-end dowels and applied dowels on wooden treenail pins (or pins made of hammered metal). In the XV-th century butt-end dowels and applied dowels were replaced by narrow imbedded one-sided ones. Gradually dowels became wider and more massive and were imbedded in opposite directions. Support of the XVII-th century icons was again often made of pinewood and became as thin as 25-35 mm; the kovcheg was often absent. Panels were usually smoothed evenly with plane.

A pinewood panel alvays has well pronounced texture of annual rings, which enables one to apply to North Russian icons the method of dendrological attribution.

Pavoloka (canvas). To prepare icons for the application of ground, pavoloka - a piece of unbleached home-made linen - was generally glued to the panel. XIV-XV-th centuries canvases have more grainy texture and thicker weaving. In the XVI-XVII th centuries old worn tablecloths, woven and embroidered in a special manner and adorned with designs of geometrical character as well as with zoomorphical elements, also served as canvases. These canvases are unique samples of old Russian fugured weaving and embroidery. They are revealed by X-raying as well as by examining exposed fragments. In the XVII-XVIII centuries linen glued to panels became thinner. As a result of the widely used West European painting technique, in the XVIII-th century more and more icons had no canvas.

Levkas (ground). The prepared panel with canvas glued to it was covered with ground made of glue mixed with chalk. It was made of finely ground chalk and solutions of animal glue of various concentrations. The chalk was taken from nearby deposits; it always contains specific impurities and is an important source of information concerning the origin of the particular painting.

The ground of ancient North Russian paintings (XIV-XV centuries) is characterized by its small thickness - from 1 to two m.m. Later, in the XVI-XVII centuries it became thicker and consisted of many layers; in some specimens the ground is 4 mm thick. Early North Russian icons have more uneven surface due to the character of trimming panels and to the thickness of their ground.

The icon ground in the XVIII century again became thinner and was 1-2 mm thick. Under the influence of West European masters toned reddish grounds began to appear in North Russia at the beginning of the thirties of the XVIII century.

Paint layer. The palette of North Russian icon-painters and their painting techniques possess great originality. Generally it may be said that their works are some-what more restrained both in the assortment of colors and in color intensity, than the works of painters in the main artistic centers of Old Russia. At the same time, since ancient times, in the course of formation of North Russian artistic centers one can observe signs of regional differences both in the composition of paints, which determines the coloring of the pictures, and in the painting technique; these differences are due on the one hand to the artistic tradition of Old Russia - the mother country, - which had been followed by painters of the particular region since ancient times, and, on the other hand, they are due to the artistic tastes of the local population, which had formed in the specific conditions of the environment. Thus, until the end of the XVII century, in the former northern domains of Great Novgorod icon-painters showed tendency towards using dense thickly-laid paints, wishing to achieve active color harmony.

On the contrary, in regions inhabited by people of Rostov-Suzdal extraction painters continued for the same period of time to use the transparent manner of applying colors, in which the ground can be seen through the colors, the strokes of brush are free, and color combinations are milder and more restrained.

In North Russian icons one can clearly see the difference between town and country painters. While town artisans-icon-painters still use such expensive materials as natural cinnabar, azure blue, green Veronese, gold (though not so often as they are used by isographs in the main artistic centers of Old Russia), country icon painters did not use them at all. Instead of gold they used light ochre of different hues, and instead of cennabar they, used red ochre. Even the assist on Jesus and Holy Virgin's robes was often imitated in ochre or auripigment.

In the XVI-XVIII centuries North Russian icon-painters often used less expensive silver or silver-gilt instead of gold. To lend the dull earthy paints greater brightness, they added to them ground mother - of pearl. This technique is used, for example, in the region of the Kubeno lake and in the river Sukhona basin.

Varnish. As everywhere in Old Russia, in the North icon-painters applied drying oils to icons. Drying oils differed in the methods of their preparation and in their quality. Varnishes on the XIV-XV century icons were usually rather thinner (0.5-0.8 mm); in the XVI-XVIII centuries their thickness increased and amounted to 1.5 mm. XVII-th century drying oils darkened, became quite black and remained viscous.

In the XVIII century painters began to apply varnishes made on the base of various resins instead of drying oils. Later these varnishes turned yellow and imparted golden-brownish tone to paintings. The application of varnishes is more characteristic of paintings by town painters, particulary of icons made by masters in Veliky Ustyug.

Thorough and comprehensive study of Old Russian paintings in the course of their restoration is of great importance for improving methods of their attribution, as well as for the development of Old Russian art as a whole. There is imperative need for conducting complete investigation of old Russian icons in the technical and technological aspect according to a system based on science; there is need for accumulation of the most important data obtained from this investigation.

81/24/3

DATA ON ICONS PIGMENTS COMPOSITION AND THEIR ATTRIBUTIVE VALUE

O.V.Lelekova and M.M.Naumova

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Icons

DATA ON ICONS PIGMENTS COMPOSITION AND THEIR ATTRIBUTIVE VALUE

O.V.Lelekova and M.M.Naumova

Institut de Recherches scientifiques de l'URSS pour la Restauration
WCNILKR
10 Khrestyanskaya pl.
109172 Moscow
USSR

Summary

A problem of icons scientific attribution according to the results of modern paint layers analyses is discussed herein.

It is recommended to use as attributive criteria the data on typical pigments mixtures which were applied by old Russian painters when dealing respectively with faces, with draperies, with architectural details on their icons. Such an approach has been verified during examinations of the three large icons complexes: the iconostasis from the Assumption cathedral of the Kirillo-Byelosersky monastery, the double-faced Novgorodian tablets and the iconostasis from the Annunciation cathedral of the Moscow Kremlin. All these relics belong to the XV century.

Up till now there are no special publications on systematic investigation of icons materials (paint layer, ground, wood). Some papers of general character do exist, but being based on written sources, they are of no use when concrete items are to be studied. The first attempt to analyse pigments on a large group of icons had been carried on at the State Tretyakov Gallery during thirties. Some information was obtained but due to poor development of technical and analytical methods it left much to be desired. For example it was very difficult to extract samples of paint layers. At the present time this operation is usually made only under a microscope, so that a specialist takes out just these pigment crystals which are needed with precise knowledge of the layer section to which pigments belong. Samples, taken without a microscope, as it was a practice earlier, do not include all necessary particles and besides contain some spurious matter. Therefore analytical procedures did not allow to determine pigments compositions properly. After the mentioned works at the STG there were no systematic large-scale icons pigments investigations.

Only separate art works underwent some analytical research. Art historians naively cherished a wrong impression of possibility to obtain unquestionable attribution for this or that icon using the raw data on pigments.

But collection of such data shows with certainty that during XIth-VXth centuries old Russian artists traditionally used about twenty main mineral and organic pigments, which were asurite, ultramarine, bice, indigo, malachite, copper green, glauconite, auripigment, cinnabar, lake, some variegated in colour and shades earthy dyes containing iron, chalk, lead white, gypsum, soot. Till the very end of the XVIth century this list remained without any alterations, but after that period artificial dyes appeared and were widely used. So it can be easily seen that a bare fact of presence or absence of any pigment does not suffice to a reliable attribution.

During the seventies years at our Institute of Restoration a problem of systematic icons pigments investigation was put under scrutiny. Icons grounds were also intensely studied. It was firmly established that painting materials really differ on various icons. Aut not so much pigments themselves as their mixtures, degrees of grinding, amounts of main pigments and of particular additions to those and so on. Each painter used specific dying mixtures for carnation, for draperies, for architectural details and prepared his preferred pigment compositions in his individual way easily distinguished from that of his immediate collegues. Any separate pigment was treated and grinded by hand without mechanical processing and its particles always bear imprint of a particular personal application.

All these subtleties received their positive proofs during the reseach investigations of the biggest classical iconostasis of the XVth century from the Assumption cathedrale of the Kirillo-Byelosersky monastery. Not less than sixty icons from the said iconostasis are preserved now. Art historians demanded a huge team for their original execution, not less than 10 painters.

But a close scruting of paint layers reveals only three persons involved, each with his specific palette, technical and artistic bents. One of them invariably used asurite for almost every dyes mixture. The lower layers of carnation on faces (called in Russian "sankyr") he made with yellow ochre and thinly grinded asurite, overpainted with ultramarine glazings. The second painter never used asurite for "sankyr", preferring instead glauconite and soot as additions to yellow ochre. He liked pigment mixtures with a high quantity of lead white as well as rather thick layers of paint.

The third artist betrayed his inclinations for bluish-grey shades on draperies, obtained by rare in the icon painting combination of asurite, ultramarine, bice and lead white. He also widely applied copper green, whereas his two collegues preferred for greens mainly glauconite.

So a scrupulous investigation of technological aspects of the Assumption cathedral icons reveals an entirely different picture of its history and artistic provenance than it was usnally conceived.

Another interesting example of the same situation emerged during examination of Novgorodian two-faced painted tablets of the XVth century, more than 20 in number with numerous compositions. Art historians including even such a first rate authority as V.N.Lazarev was, were deeply convinced that these tablets were executed by several painters, not less than six altogether. But an analysis of paint layers imposed just another decision. It occured that all technological features - mixtures, degrees of grinding, microadditions - for all tablets are strictly identical. Conventional rendering of soil upon which all figures stand (called in Russian "posem") were painted just in the same manner with crystals of copper green, glauconite and with particles of lead white and soot "Posems" are decorated with identical black patherns composed of soot. Greenish "sankyrs" are made of yellow ochre, fine glauconite crystals, cinnabar and separate particles of soot. Only on same faces without a due regularity some crystals of asurite can be discovered /basic copper carbonates $2CuCO_3 \cdot Cu(OH)_2$/. Upon all the tablets an olive mixture used for draperies and architectural details is just the same as "posems" backgrounds. An intensity of some shades depends upon amounts of lead white and alters accordingly from dark-olive to pale greenish.

The only blue pigment for all the tablets appeared to be asurite. Mixted with lead white it gives all the shades of blue. With it are painted all blue draperies and roofs. It is necessary to say that a thick layer of linseed oil above the paintings renders intense blues somewhat emerald green and prevents an adequate impression of original blues on draperies and roofs.

As compared with blues reds appear rather variegated in shades, from pale pink to dark brownish red. Widely used was an organic red dye of lake type, disovered almost on all the tablets in the paint layers for draperies and architecture. Draperies were painted mainly with a mixture of lake and lead white and modelled with blue asurite. The same asurite applied over lake renders the latter into pale brownish shade, which also can be observed upon draperies made of brownish red ochre. Lights upon these draperies also contain an addition of asurite.

These Novgorodian tablets of the XVth century were painted with twelve main pigments: lead white, asurite, malachite, glauconite, lake, cinnabar, red, brown and yellow ochres, auripigment (for some details of draperies) soot, umber. Various mixtures of these pigments serve as a base for the colour-ful palette of the Novgorodian tablets of the XVth century. Their grounds are porous and filled with chalk ($CaCO_3$).

Relying upon these facts one has the right to conclude that all the tablets were painted either by a single artist or in a single work-shop where pigments and artistic methods were substantially the same.

Some interesting results were obtained during examinations of the most important complex of the beginning of the XVth century - the iconostasis from the Annunciation cathedral in the Moscow Kremlin. It was painted by the most famous old Russian artists Andrew Rublyov, Theophanos the Greek and Prokhor. These data from written sources duly conform to the analytical ones which also reveal three hands in the execution of the Annunciation cathedral iconostasis. These renowned artists worked independently. The chief in authority among them, Theophanos the Greek, painted the central part of the iconostasis, big icons of the Deisis range. On his palette are remarkable exceptionally large (to 500 mc) dark-green sometime almost black crystals of glauconite, used in mixtures with yellow ochre and ultramarine for lower carnation layers, "sankyrs". Such gross glauconite crystals on other Russian icons were practically never used for "sankyrs". Equally unusual for Russian "sankyrs" are mixtures of glauconite with ultramarine. For all Deisis range only ultramarine served as blue. It was extremely pure without spurious ore additions.

The Feast Range betrays the participation of two artists. Just as on the icons of the Deisis range here are particularly typical "sankyrs", easily divided in two groups. The left part of the Feast Range belongs to A.Rublyov (icons "Annunciation", "Purification", "Baptism", "Entry into Jerusalem", "Raising of Lazarus") and is characterised by rather cold greenish "sankyrs", which shades are determined by yellow ochre with a considerable admixture of finely dispersed soot and of separate small crystals of glauconite together with cinnabar. The right part executed by Prokhor has for its "sankyrs" yellow ochre with separate crystals of copper green. Soot was applied on a far smaller scale than in the left part of the Feast range.

Both Russian painters as compared with Theophanos the Greek completely avoided usage of ultramarine. Their only blue pigment throughout was invariably asurite.

The stated above results of analytical investigations of the three important complexes of old Russian easel painting reveal personal attitudes of any artist involved and can safely be used for attribution purposes, whereas purely stylistic criteria, always highly subjective, yield only divergent conclusions. One and the same icon is often declared to be an art work of Novgorodian, of Moscow of for that matter of Rostov schools according to unverifiable predilections of art historians.

The method of attribution recommended above seems very promising but as it is new one needs a by far larger accumulation of experimental data, of course received not for separate icons but for big ensembles such as the Assumption cathedral iconostasis from Vladimir, the Trinity cathedral iconostasis after A.Rublyov from Zagorsk, the Virgin Nativity cathedral iconostasis from the Pherapontov monastery, painted by Dionisius. It is necessary to find out the convergence and diversity of respective technological methods and attitudes for each related artistic team and within each team as well.

After solution of these problems it would be possible to tackle the manifold questions of isolated icons provenance. Only in such a way can be achieved objectively reliable attribution for the choisest icons of primal importance from the best national collections.

81/24/4

SOME PROBLEMS IN THE RESTORATION OF OLD RUSSIAN PAINTING

N.A.Hagmann

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Icons

SOME PROBLEMS IN THE RESTORATION OF OLD RUSSIAN PAINTING

N.A.Hagmann

Russian Art Restoration Centre I.E.Grabar
B. Ordynka, 60/2
113095 Moscow
USSR

This report discusses certain features of old Russian icons as objects of restoration and the underlying principles of dealing with such relics of the past. It also puts problem of the historic authenticity of the restored works.

The painting of old Russian icons employed the egg distemper technique and was notable for its exceptional stability and immutability of the colours. However, its traditional coating usually consisted of boiled oil with dissolved natural resins, With the passing years such a coating darkened so much that the image became almost indistinguishable.

In ancient times the darkened painting was renovated. It was done in two ways. One consisted in the removal of darkened varnish by washing it out. But the imperfection of the technique of washing led to decay, when damaged images had to be "corrected" with paint. Often such "correction" led to entire repainting.

There was another method: the darkened image was not washed out, but simply painted over, trying to repeat the image as precisely as possible.

In both cases the new painting was covered with oil varnish, which led sooner or later to a new "renovation". That is why there is no single paint layer on ancient icons, but two or more, one over the other.

The restoration of such icons includes the removal of the later layers. But the latter can be of aristic or historic value. We know from a number of written sources that the "renovation" of icons was entrusted to the most famous masters of the time. Thus the removal of the later layers is not always desirable, even if beneath lies an ancient and excellent painting.

To resolve this problem experiments were carried out to divide old and new layers and to transfer them intact to a new support. For a long time these experiments produced no meaningful result, but recently the staff of the All-Union Scientific Institute of

Restoration in Moscow gained some significant successes, and we hope that this very difficult problem will be soon resolved.

However, for the time being the restorers rather often are confronted with a choice: whether to discover a genuine work of art or to conserve the latest superimposition that has certain historic or artistic value.

Sometimes it concerns not only the whole overpainting but only a partial painting that changes something in the work, for example, the ground.

The method mentioned above is only at the initial stage of its developement, but it is without doubt that the possibilities of the natural methods will steadily grow with the passing years.

From this point of view not only the latest painting which has artistic and historic value acquires great importance, but also all layers of different periods. A comparative study of them will open new possibilities for the attribution of single monunents and the whole complexes, to establish the origin of a particular monument: the zone, cultural centre and architectural complex, to retrace its history, displacement and other events the importance of which for ancient Russian art is now difficult to calculate.

That is why it is necessary to conserve at least the patterns of all the consequent layers of the work in question.

Evidently such patterns should not be conserved separately from the original (that would be rather simple), but at its own place in a natural state, because for future research it is very important to conserve the natural correlation of the components of the patterns that could be easily destroyed when they are moved to a new support.

In the practice of the Soviet restoration school it is accepted from the beginning to leave on the restored icons small "control pieces" of all layers, including the darkened original coating.

However in recent years this tradition was neglected.

Some restorers even delete "control pieces" left on the icon many years ago. They do it in the desire to eliminate everything that spoils to some extent the purity of the style of the work of art.

But the elimination of the "control pieces" certainly limits the possibilities of historical science, as we imagine it to become in the nearest future.

The most discussed problem of ancient Russian icons concerns the filling-up of the losses or, in other words, the elimination of distortions in the painting which, appeared as a result of deterioration. We can discern here two contradictory tendencies. Some restorers are interested in the author's version of the monument and for the sake of discovering it they are willing to reconstruct some elements of the picture. Others, on the contrary, appreciate above all the documentary authenticity of a distorted original and see any filling-up as a damage to this authenticity.

It is hardly necessary to explain that extensive fillings-up of a substantially destroyed work of art do not help to see the character of the painting and create difficulties in perceiving it.

On the other hand a total refusal to neutralize losses deprives us sometimes of the possibility to see the genuine nature of the painting. Experience has shown that a sincere rearranging of some lost elements of the image helped to understand a destroyed monument in a correct way.

Specialists are facing the problem of elaborating a certain generally accepted approach and standard solutions, that should help to avoid a subjective interpretation of ancient monuments and to help future research workers "to read" correctly a restored work of art without special instruments or documents created in the course of restoration.

Such a measure is essential if we take as a rule that museum exhibits should be freely available not only for experts but for every serious spectator.

A special problem is posed by the fact that several precious monuments of ancient Russian art were restored in the beginning of this century when the methods of restoration were in an embryonic state.

This creates a special problem. Now a days a restorer eliminates the latest layers using special solvents, which have a clear elective ability and acting only on the layers to be eliminated. Besides, he has modern special instruments helping to distingnish ancient images of different periods.

The restorer of the past had none of them. He used only his own intuition and the experience of his predesessors.

No wonder sometimes he could make mistakes which could start a kind of tradition.

Work has recently begun to explore monuments restored at the beginning of this century and to eliminate errors.

A peculiarity of Russian icons is that various materials have been used to cover paintings in different regions and in different periods of time. The ways of using them had some nuances, too.

Thin vitrious coatings prevail in the classical icons of Moscow. In northern regions they are more intense, not always even and sometimes leaking.

From the 17th century onwards some artists preferred a spirituous solution of shellac to traditional drying oil.

All that produced certain originality in the monuments of different regions.

In our days we do not consider opportune to recreate the coating of an ancient painting using old receipts, first of all because the traditional coatings, as we have already mentioned, do not possess the necessary stability. Our task is to learn to recreate the peculiarities of these coating films using more perfect modern materials.

81/24/5

METHODS OF EGG-TEMPERA PANEL PAINTING CONSERVATION EMPLOYED IN THE STATE HERMITAGE

T.D.Chizhova

ICOM Committee for Conservation
6th Triennial Meeting
Ottawa 1981

Working Group: Icons

METHODS OF EGG-TEMPERA PANEL PAINTING CONSERVATION EMPLOYED IN THE STATE HERMITAGE

T.D.Chizhova

The State Hermitage Museum
191065 Leningrad
USSR

Abstract

In the present paper methods of conservation old Russian, Byzantine and Italian egg-tempera panel painting used in the easel painting restoration studio of the State Hermitage for the last 25-30 years are summed up. The methods of consolidation both the painting and the ground with sturgeon glue water solutions, egg emulsion, natural and synthetic resins are described. The consolidation methods depend upon the character and degree of the destruction of the object. Methods of straightening and stabilization of supports are also given.

I. Introduction

When speaking about egg-tempera panel painting conservation, monumental objects similar in the technique and technology of the painting and in the mode of preparation the support and the ground should be taken and considered as a separate group. In the present paper some problems connected with the conservation of Byzantine and Old Russian icons, early Italian and Spanish primitives are discussed. The support of such works is usually some wood of comparatively soft species. The support, which is made of 2-3 (and sometimes even more) rather thick boards glued together, required additional fastenings, such as various nailed or inset splines which, besides, protected the support from warping. It was not seldom that canvas strips were pasted on in the places of gluing on the right side, thus making the support fastening still more reliable. Sometimes the canvas covered all the support surface. The type of the wood structure, as well as the presence of the canvas made it necessary to have a thick layer of ground. Usually it is glue ground with chalk or alabaster as inert.

Before proceeding to the problems of conservation, the reasons of the destruction of the tempera painting works are to be considered.

In the first place, it is wrong conditions of storage. Under increased moisture conditions the ground becomes loose, the paint layer flakes off, the support gets deformed. The examination of a number of works of tempera panel painting from the collection of the State Hermitage showed that most of the supports of Byzantine and Italian icons were affected by the larvae of beetles and dilapidated. Due to the fluctuations of air temperature and moisture, the ground with the painting came off the badly decayed support.

Russian icons are more seldom invaded by the beetles. In the conditions of moist and cold climate the icons suffer mostly from fungi, glue destruction in the ground and deterioration of the support itself. /I/.

The conservation of tempera panel painting has the following tasks: to consolidate the painting and the ground on their own support, to fasten the decayed support and in some cases to straighten out the warped wooden support.

The restoration of works of painting in the State Hermitage is carried out mostly according to routine methods by consolidating both the paint and the ground with water solutions of sturgeon glue, as a material closest to the execution technique of the object itself. The sturgeon glue possesses some very valuable properties, such as good penetrating ability, elasticity, reversibility. /2/.

The methods applied for the consolidation of the paint layer and the ground are dictated by the character of the destruction. The choice of the glue - water ratio depends upon the firmness of the ground, and in this no precise recommendations can be given, the more so that various kinds of destruction are to be found in one object. Nevertheless, some classes of destruction most often met with in practical work can be discussed, and some general methods of consolidation, as well as an approximate ratio percentage of the glues, can be recommended.

2. Consolidation of the paint layer and the ground with the sturgeon glue water solution

The destruction of the binding medium of the chalk ground is characteristic of the works of Old Russia tempera painting and is most often met with. This destruction is due to the long stay of the object in high moisture conditions (in churches). The chalk ground becomes loose, and the slightest changes of the temperature and moisture regime cause the paint layer to come off and crumble to a considerable degree. In cases like this the ground must be filled with a sufficient amount of the binding medium. The method of repeated impregnation of the ground with a thin (I-2%) warm (about 35-40°C) solution of sturgeon glue is used. To make the glue penetrate into the whole thickness of the ground, the paint layer is slightly impregnated with 40% ethyl alcohol water solution before the first impregnation with the glue. The impregnation with the glue is performed with a soft flat brush. Every next imregnation is to be undertaken only after the glue got fully into the depth and began to dry up. In no case ahould much glue be put on the paint surface or impregnations be undertaken after short intervals because the ground can "flow". The impregnations are discontinued as soon as a thin glue film begins to appear on the paint surface (it means that the ground is fully filled with the binding medium). After the last impregnation, the paint layer is covered with two layers of tissue-paper and ironed with a warm iron (not more than 90-95°C) until full drying.

When working with this method, it should be born in mind that to achieve a more even impregnation of the ground with the glue, the impregnation must be performed on all the surface simultaneously (in case of big objects within one board). Both the tissue-paper and the glue film on the surface of the paint layer are removed by wetting small areas of the paint with small quantities of warm water. Here it is necessary to see that the water should not get into the depth of the ground. After removing the glue remnants, the cleaned area should be wiped dry.

The temperature and moisture regime fluctuations cause the ties between the support and the ground to break. In these cases, the ground from the support appear along the craquelures. This kind of destructions require consolidation with 4-6% glue solution and

ironing with a warm iron through I-2 layers of tissue-paper. In this case, it is sufficient to consolidate the paint only in areas where the ground came off the support. Hot glue is brushed on the paint surface, and when the surface is ironed with a warm iron, the glue penetrates under the ground layer through the open crackes and glues up the ground to the support.
In cases when there is some canvas on the icon, the moisture fluctuations cause some breaks in the ties between the support and the canvas (usually the tie between the ground and the canvas remains sufficiently firm), and some closed risings appear. In these cases the glue (5-7%) is introduced under the canvas with a syringe, and the area of the paint with the risings are thoroughly pressed and smoothed down with the fingers so that all the lacunae should be filled up. Care should be taken that only the necessary amount of the glue is left under the canvas. The area which is being consolidated must be dried up well with a warm iron. Only the areas with the paint off should be consolidated.
Great moisture decrease leads to a sharp shrinkage of the board with the result that along the grains of the wood there may appear dangerous rows of roof-like blisters ("tents"), that is, the ground and the paint bulge out forming rigid edges. 5-7% glue solution is introduced with a syringe or a soft brush under the ground. In the process of drying, the glue begins to compress the ground. Now, the area of the paint around the roof-like blisters is wetted with thin glue (I-2%). The paint is slightly drawn off aside with the help of the fingers, and the raised parts of the paint and the ground on the support are laid down.
After consolidation the paint area should be thoroughly ironed with a warm iron. This kind of destruction of the painting requires particular care. The work should be carried out on small areas (not more than 3-4 cm along the length of the blisters).
Sometimes, during conservation work, the restorer faces the necessity to correct the mistakes of former resorations. It is not seldom that old rigid raised parts of the paint layer and the ground along the craquelures resulted from consolidation with thick glue. In these cases, the method of closed or open steaming is used. 4-5% glue solution is abundantly put on the area of the painting with such deformations, and the glue hardened in the ground is steamed out with a warm iron through a film of teflon (or upon the glue itself). The raised areas should be continually pressed down with the fingers. When the ground becomes sufficiently elastic, the glue remnants are removed with a brush, and the ground is ironed with a warm iron through tissue or filter paper. Simultaneously, the raised areas are

pressed down and laid along the craquelures.
Of particular complexity are works of tempera painting with the lost firmness of the alabaster (gypsum) ground. In the process of consolidation such grounds begin to run. The method of consolidating with sturgeon glue after preliminary impregnation of the ground with 4-6% polybutyl methacrylate (PBMA) solution in xylene was used in the State Hermitage with good results. The introduction of a small amount of the polymer protects the ground from being washed away and permits the painting to be consolidated with sturgeon glue water solutions.
In the routine work of conservation of tempera panel painting, the sturgeon glue is used as the main but not the only material. In some cases, the character of the destruction of the object requires application of other materials.

3. Consolidation of the paint layer with the help of egg emulsion

Works of tempera painting with small pieces of paint flaking off the ground are consolidated with egg emulsion. The emulsion is made from egg yolk mixed with water in the ratio I:2. A small amount of the emulsion is put with a soft brush on the flaking off area of the painting. When the emulsion begins to get hardened, the flakes of the paint layer are combed down with a "tooth" (such as used by the gilders in polishing gold). The emulsion film remained on the surface may be removed with a wad either dry or wetted in a small amount of the same emulsion. The method is good for fixation of the flakings of the gilded backgrounds and the gold finishing strokes ("assist") of tempera paintings.

4. Consolidation with wax -resin mixtures

The method of consolidation of paintings with wax-resin mixtures is used in the routine restoration work in the Hermitage comparatively seldom, only in cases either when the object was restored before by applying this method (this is often the case with Byzantine icons) or when the wooden support is badly damaged by the beetles. The method of consolidation with wax resin mixtures used in the Hermitage is similar to that applied in other countries.

5. Consolidation of support

It is not seldom that the conservation of tempera panel paintings requires consolidation of the support. Since the I950s low grade polybutyl methacrylate has been used for consolidating the wooden supports damaged by the beetles or decrepit. Usually consolidation is achieved by means of deep impregnation with PBMA xylene solutions and additional treatment with the acetone solutions of the polymer. The percentage ratio of the resin and the solvent, as well as the number of impregnations, depends upon the state of preservation of the object. As mentioned above, PBMA, consolidating the support, allows the painting and the ground to be impregnated with sturgeon glue water solutions. This method succeeded the earlier applied methods of impregnation the wood destroyed by the beetles with hot sturgeon glue with the addition of blue vitriol and ethyl alcohol, and with hot boiled oil as well. A number of destroyed supports of Byzantine icons was impregnated with the wax-resin mixture.

6. Straightening of warped support

The straightening of warped panel painting supports may be carried out by applying the traditional method of wetting the back side with simultaneous steady pressing. This method requires use of a "cradle" (a system of immovable and movable planks). In this way earlier were straightened out the supports of a number of early Italian paintings. This method, however, has an essential drawback: to perform a cradle it is necessary to remove old fastenings and make the support of the object thinner. But the back side is an important part of the object as by the mode of its treatment, the form and mode of fastening the splines it is possible to judge about the age of the work with a great degree of certainty. That is why, the straightening out of icons in the Hermitage was employed rather seldom, only in cases of urgency. For example, when straightening out the support of a big Byzantine icon, it was suggested to make sectioned cradle. Another Byzantine icon was in a very bad state of preservation, and after the wood was consolidated with PBMA and the support straightened out it was necessary to reline the icon on a new board with inset splines. There were some cases when cradles was used for Russian icons. A method of impregnation the wood with a mixture of ethylene glycol and bleached shellac in ethyl alcohol was studied during some past years. It was suggested by a Swedish restorer Titov for straightening out the supports of the painting destroyed by the beetles /3/. After a number of experiments found were some ratios of shellac, alcohol and ethylene glycol permitting also of straightening out supports not damaged by the beetles. Some Old Russian icons were straightened out by applying this method. For fixing the straightened support it is quite sufficient to use the original splines.

For the 25 years past more than 300 objects of Old Russian tempera painting, about 200 Byzantine icons, about 50 works of early Italian painting and 6 works of Spanish painting of the 2nd half of I5-I6th centuries underwent conservation by the above methods in the State Hermitage easel painting restoration studio. Long observation of the state of preservation of tempera panel paintings which underwent conservation showed that in normal conditions of storage no more interference of the restorers is required for these works. Some Byzantine and Italian icons make an exception. They returned to the studio for repeated conservation as the supports of these objects were badly damaged by the beetles.

References

I. Filatov V.V. Russian easel tempera painting. Technique and restoration. Moscow, I96I, 43-46.

2. Osnovy museynoj konservacii i issledovaniya stankovoj zhivopici. (The principles of museum conservation and investigations of easel painting works), ed. by Ju.J.Grenberg, Moscow, I976, I95-I96.

3. Titov B.L. Vypryamlenie pokorobivshikhcya derevyannykh osnovanij zhivopisi (Flattening of warped wooden supports of paintings). Soobshcheniya WCNILKR. N 20, M., I967, 80-84.

81/24/6

METHODOLOGIE DE L'ETUDE DES ICONES: LES SUPPORTS ET LES CADRES
L'EXEMPLE DES ICONES BULGARES

R. Van Schoute et H. Verougstraete-Marcq

Comité pour la conservation de l'ICOM

6ème Réunion triennale

Ottawa 1981

Groupe de travail: Icônes

METHODOLOGIE DE L'ETUDE DES ICONES: LES SUPPORTS ET LES CADRES

L'EXEMPLE DES ICONES BULGARES

R. Van Schoute et H. Verougstraete-Marcq

Laboratoire d'étude des oeuvres d'art
par les méthodes scientifiques
Université catholique de Louvain
53, rue Cardinal Mercier
1348 Louvain-la-Neuve
Belgique

Si les méthodes de laboratoire sont une aide précieuse dans l'étude des icones, les simples observations à l'oeil nu peuvent déjà donner des informations utiles à la conservation des oeuvres et à leur situation dans l'histoire de l'art. Nous avons procédé à des observations de cet ordre lors d'une exposition itinérante d'icones bulgares présentée aux Musées royaux d'art et d'histoire à Bruxelles de novembre 1977 à février 1978.

METHODOLOGIE

Sur les 150 icones sur bois (le reste des 203 numéros du catalogue était constitué de pièces d'orfèvrerie, de tissus, d'oeuvres sur papier), nous avons pu examiner 29 pièces en choisissant un échantillonage le mieux possible distribué dans le temps. Ont été examinées : une icone du XIIe-XIIIe siècle, une du XIIIe-XIVe, une du XIVe, une du XIVe-XVe, deux du XVe, trois du XVIe, une du XVIe-XVIIe, huit du XVIIe, une du XVIIe-XVIIIe, sept du XVIIIe et trois du XIXe siècle.
On s'est reporté au catalogue de l'exposition (1) pour les numéros des icones, les sujets, la datation, les lieux de conservation et de provenance. Ces données sont reprises dans un tableau en annexe, de même que les dimensions qui ont été vérifiées.
Les observations portent principalement sur la technologie du support et de ses renforcements, et sur le système d'encadrement. Chaque fois on s'est efforcé de faire la distinction entre ce qui était original et ce qui était le fait de remaniements ou de restaurations.

LE SUPPORT

Des bois d'essences variées sont utilisés pour la confection de ces supports : cyprès (ou résineux) (15, 58, 97, 122, 143, 147, 150) tilleul ou peuplier (12, 33, 46, 54, 55, 57, 69, 70), fruitier (28), chêne (32, 115, 120, 128) ou noyer (36).
Dans de nombreux cas toutefois, l'identification des bois est difficile à cause du badigeon qui recouvre le revers.

L'épaisseur des supports varie entre 2.7 et 4 cm.

Les supports sont fait tantôt d'un seul élément (15, 22, 24, 32, 36, 54,55, 57, 70, 115, 122, 128, 147), tantôt de deux éléments d'égale largeur (14, 33, 69, 150) ou d'inégale largeur (12, 35, 41, 46, 58, 97, 120, 124, 130, 143). Un certain nombre d'icones ne présentent au revers aucun renforcement original apparent (12, 14, 15, 22, 32, 33, 54, 57, 70, 122, 128).
D'autres sont renforcées au moyen de traverses qui semblent originales dans la plupart des cas. Ces traverses sont parfois simplement collées, clouées ou chevillées au support (36, 46, 115); dans le n° 36 quatre clous sont enfoncés à travers la couche picturale depuis la face; les clous et les chevilles maintenant les traverses du n°46 apparaissent également à la face.

Les traverses peuvent être encastrées, et parfois de surcroit clouées ou chevillées au support (41, 58, 124, 130, 143, 147, 150); la traverse encastrée du n°41 est fixée au moyen de quatre groupes de deux chevilles; celle du n°58 au moyen de clous enfoncés depuis la face.
Certaines icones présentent des traverses insérées en "fuseau"; ce système permettait de bloquer efficacement la traverse dans le support (Fig. 3). Le sens de l'insertion des fuseaux est parfois alterné, pour répartir les effets souhaités, tel le renforcement d'un assemblage ou le contrecarrement de la déformation du support.

Le gauchissement du support parait avoir été une des préoccupations des menuisiers; ceci est confirmé par le fait que même des supports d'un seul élément recevaient des traverses. En outre, les extrémités de ces traverses étaient souvent chanfreinées de manière à éviter qué leur épaisseur à cet endroit, additionnée au gauchissement du support, n'augmente la profondeur de l'icone et risque par exemple de l'écarter de la paroi qui la supporte. Dans la série d'icones examinées, les traverses appliquées de profil simple (voir Fig. 1, a et b) ont longtemps coexisté avec les traverses trapézoidales incrustées (Fig. 1,c). Un profil plus complexe est adopté fréquemment dans les icones de la fin du XVIIIe et du XIXe siècle (Fig. 1,d et e).

Le renforcement des assemblages peut encore se faire au revers au moyen de clous (97) ou de tourillons à moitié apparents (35).

Le bois du support a parfois été renforcé à la face au moyen de morceaux de toile (15, 28, 33, 41). Dans les autres cas il n'y a pas de trace de toile visible, ou cette observation n'a pas pu être pratiquée, la couche picturale recouvrant bien le support. Des morceaux de parchemin ont été observés dans deux cas (28 et 58).
Des queues d'aronde sont adoptées d'origine pour renforcer le support à la face dans un cas (130) et sont donc recouvertes par la couche picturale.

Il semble que le bois utilisé n'était pas toujours sec, puisqu'entre la fabrication du support et l'exécution de la couche picturale on a, au moins dans trois cas, attendu la stabilisation du support. Des joints ouverts sont bouchés au revers dès l'origine, au moyen de copeaux de bois ou d'une languette, et l'enduit étendu après, éventuellement sur un renfort de toile. Trois icones de la série présentent un joint restauré à l'arrière et une couche picturale intacte à la face (41, 46, 120).

Une icone (28) mérite une attention particulière, puisqu'il s'agit d'une icone du XIVe siècle (?) insérée dans une icone plus récente (XVe siècle?) (Fig. 4) et que la datation de cet ensemble a suscité quelques controverses (3). La complexité du support est intéressante à relever, bien que dans le cadre de ce travail, nous n'avons pas la prétention d'apporter des précisions quant à la datation des diverses parties. Six pièces de bois forment le support à la face (Fig. 2). Les pièces 1, 2 et 3 constituent un encastrement dans la pièce 4. La pièce 2 est une restauration d'un angle abimé de l'icone centrale. La pièce 3 est une restauration de plus grande ampleur, à un endroit où le support présente au revers des dégâts importants. La pièce 5 est collée à la 4; le joint est renforcé à la face au moyen d'une languette de parchemin, le tout recouvert de la couche picturale. La pièce 6 est également collée à la 4, mais ici, il n'y a pas de renforcement de parchemin, et le joint sépare visiblement les surfaces colorées. Cette pièce se présente à l'arrière également comme un élément séparé, avec une surface soigneusement égalisée alors que le

reste du support marque le travail irrégulier d'un instrument. Le motif décoratif entre les deux icones est exécuté en partie sur de la toile de renfort. Cette toile se superpose par endroits aux bords de l'icone centrale. Il est à noter que la zone inférieure de ce motif, c'est-à-dire toute la partie qui se trouve en dessous de l'icone centrale est refaite (motif plus mou).
D'autres examens s'avèrent nécessaires pour expliquer la complexité de cette icone. On peut seulement avancer l'hypothèse que le cadre est constitué par un découpage d'une icone existante.

LE SYSTEME D'ENCADREMENT

Une seule icone se présente sans encadrement (122). L'encadrement peut consister en un simple bord peint, dans le plan du sujet principal (28, 115, 120, 143, 147, 150), ou bien encore le bord plat de l'encadrement est légèrement surélevé (12, 14, 15, 22, 24, 32, 33, 36, 97). Un encadrement hors du plan peut comporter des éléments en relief (35, 41, 46, 54, 55, 57, 58, 69, 70, 130). La plupart de ces encadrements sont faits dans les planches mêmes du support; certains éléments en relief peuvent être rapportés (cloués ou chevillés). L'encadrement de l'icone 24 est fait de deux traverses indépendantes non originales.

En ce qui concerne la décoration de ces encadrements, pour la première catégorie, c'est-à-dire ceux situés dans le plan, certains sont monochromes (22 et 120 : rouges; 115), d'autres polychromes (143, 147), d'autres encore comportent des scènes historiées (28; 150 : les scènes forment deux bandes verticales; en outre une scène se remarque au dessus et une en dessous de la scène centrale; un filet ocre sépare les scènes).

Les encadrements plats légèrement surélevés par rapport au plan peuvent également être monochromes (15 : beige comme le fond; 32, 36). Un filet extérieur d'une autre couleur complète parfois ce cadre monochrome (24 : or comme le fond avec un filet extérieur rouge; le vêtement du Christ déborde sur l'or du cadre; 33, 97 : l'encadrement est recouvert d'une feuillle d'or comme le fond et décoré d'un filet extérieur rouge). Dans le cas d'une icone biface l'encadrement est d'un côté ocre jaune commme le fond; de l'autre côté, il est orné de personnages séparés d'un filet rouge. Un dernier encadrement dans cette série est orné de scènes séparées d'un filet rouge (12).

Les encadrements hors du plan en relief se présentent de manière assez variée. Ils peuvent comporter une partie plate accompagnée d'un motif en relief, soit en épi (35 : l'épi est doré et le filet plat est rouge), soit un motif torsadé (41, 57, 69 : les torsades sont dorées et le filet extérieur est rouge; 130); dans l'icone 41, des espaces avec peintures sont disposés en rectangles tout autour de la scène principale dans des encadrements torsadés).
Les torsades sont parfois accompagnées de rinceaux de feuillage, de losanges, de fleurs; les reliefs sont généralement dorés et accompagnés d'un filet plat rouge (46, 54, 58). Dans l'icone 70, les feuillages diffèrent dans l'icone de la Vierge et dans celle de saint Jean qui font pendant.

CONCLUSION

Il est largement admis aujourd'hui que dans la conservation d'une oeuvre d'art, le support joue un rôle primordial. En 1976 nous avons publié les résultats d'un examen pratiqué sur les supports d'icones slovaques faisant partie d'une exposition itinérante présentée en 1973 au Stedelijk Museum de Louvain (2).
Dans les deux séries d'icones, nous avons tenté d'établir la distinction entre ce qui est original et ce qui est apport ultérieur. Cette distinction est indispensable pour la conservation (et son histoire) et pour l'histoire de l'art.

Dans les icones de la présente série, quelques éléments aux revers apparaissent comme des restaurations (la traverse du 12, les deux traverses du 33, 122); pièces et languettes de bois sont insérées dans le support du 57; les queues d'aronde dans les 69, 70 ne sont pas originales. Dans l'icone 69 on a écarté des traverses appliquées et il en subsiste des traces.

Les restaurateurs ont donc eu recours à des techniques traditionnelles. Ceci souligne encore la difficulté d'établir la distinction entre les éléments originaux de l'oeuvre et les restaurations.

Ces quelques observations ponctuelles pratiquées sur un nombre limité de pièces ne permettent aucune conclusion définitive en dehors d'une mise en évidence de la diversité des pratiques technologiques; mais elles invitent à croire que pratiquées sur un plus grand nombre de pièces, elles contribueraient à une connaissance des icones utile à leur conservation et à leur histoire.

TABLEAU DES ICONES ETUDIEE

n°	sujet et dimensions (cm) (HxL)	date	lieux de provenance et de conservation
12	Saint Nicolas (102.5 x 80)	XIIe-XIIIe s	prov. : Nesebǎr cons. : Nesebǎr, musée communal d'histoire (inv. 14)
14	Christ Pantocrator Mère de Dieu Ele-ussa (108 x 96.5)	XIIIe-XIVe s	prov. : Nesebǎr cons. : Sofia, Galerie nationale (inv. 2488)
15	Saint Jean de Rila (77.2 x 56)	XIVe s	prov. : monastère de Rila cons. : musée du monastère de Rila (inv. 213)
22	Saint Arsène (80 x 52.5)	XVe s	prov. : monastère de Rila cons. : musée du monastère de Rila (inv. 281)
24	Christ Pantocrator (96 x 73)	XVe s	prov. : monastère de Kremikovci cons. : Sofia, Galerie nationale (inv. 1)
28	Saint Georges et saint Dimitri à cheval (85 x 80.5)	XIVe et XVe s	prov. : Sozopol cons. : Sofia, musée archéologique et de l'église (inv. 3140)
32	Déesis (45 x 70.4)	1577	cons. : Sofia, musée archéologique et de l'église (inv. 3844)
33	Saint Georges assis sur un trône (79.8 x 51.8)	XVIe s	prov. : Plovdiv cons. : Sofia, Galerie nationale (inv. 187)
35	Philoxénie d'Abraham (93 x 69)	1598	prov. : Loveč cons. : Sofia, musée archéologique et de l'église (inv. 3332)
36	Saint Constantin et sainte Hélène (83.8 x 60.6)	XVIe-XVIIe s	prov. : indéterminée cons. : Nesebǎr, musée communal d'histoire (inv. [illegible])
41	Jean le précurseur (93 x 66)	1604	prov. : Vraca cons. : Sofia, Galerie nationale (inv. 951)
46	Christ Pantocrator (88 x 68)	1614	cons. : Dobarsko, église de saint Théodore Stratilate et de saint Théodore Tiron
54	Sainte Parascève et sainte Dominique (67 x 50)	XVIIe s	prov. : Plovdiv cons. : Sofia, musée archéologique et de l'église (inv. 3858)

55	Sainte Marina (61 x 28)	XVIIe s	prov. : Plovdiv cons. : Sofia, musée archéologique et de l'église (inv. 3918)
57	Saint Georges terrassant le dragon (87 x 61)	1667	prov. : église de Saint Georges, monastère de Kremikovci cons. : Sofia, Galerie nationale (inv. 9)
58	Christ Pantocrator (90 x 65.5)	fin XVIIe s	prov. : monastère d'Etropole cons. : Sofia, Galerie nationale (inv. 223)
69	Synaxis des archanges (89.8 x 53)	XVIIe s	prov. : Veliko Tărnovo cons. : Sofia, Galerie nationale (inv. 67)
70	Mère de Dieu et saint Jean le théologue (77 x 29; 77 x 28.8)	XVIIe-XVIIIe s	prov. : Arbanasi, église des archanges cons. : Veliko Tărnovo, musée départemental d'histoire (inv. 50-63)
87	Crucifixion (118.5 x 111.5)	XVIIe s	prov. : Nesebăr cons. : Nesebăr, musée communal d'histoire (inv. 158)
97	Saints Pierre et Paul (71 x 48.9)	XVIIIe s	prov. : Metochion de Orlica, église des saints Pierre et Paul (entourage de Rila) cons. : Rila, musée national du monastère (inv. RM-III-305)
115	Christ en évêque (75 x 50.5)	1797	cons. : Samokov, église métropolitaine (inv. 130)
120	Les quarante martyrs de Sebaste (75.7 x 57.2)	XVIIIe s	prov. : région de Veliko Tărnovo cons. : Sofia, Galerie nationale (inv. 293)
122	Ascension du prophète Elie (89.2 x 52)	XVIIIe s	prov. : Plovdiv cons. : Sofia, musée archéologique et de l'église (inv. 3861)
124	Naissance de la Mère de Dieu (55.7 x 47.5)	fin XVIIIe s	prov. : Veliko Tărnovo cons. : Sofia, Galerie nationale (inv. 123)
128	Les douzes fêtes (65.5 x 48.5)	XVIIIe s	prov. : chapelle de la Chrelu, monastère de Rila cons. : Rila, musée national du monastère

130	Christ Pantocrator (84.5 x 57.3)	1798	prov. : Raduil près de Samokov cons. : Sofia, Galerie nationale (inv. 127)
143	Mère de Dieu Hodigitria (81.4 x 59)	1825	prov. : chapelle saint Nicolas du Katolicon, monastère de Rila cons. : Rila, musée national du monastère
147	Saint Georges et saint Dimitri (66 x 44)	XIXe s	prov. : monastère de Bešoviski cons. : Sofia, Galerie nationale d'archéologie (inv. 2981)
150	Saint Jean de Rila entouré dépisodes de sa vie (104 x 83.8)	1839/40	prov. : église de Koprivštica cons. : Plovdiv, trésor de l'église métropolitaine (inv. 4)

REFERENCES

1. Icones bulgares du IXe au XIXe siècle. Catalogue d'exposition, 26-11-1977 au 12-2-1978, Bruxelles, Musées royaux d'art et d'histoire, s.l., s.d.
2. J. Grosemans, R. Van Schoute et H. Verougstraete-Marcq, Icones slovaques : supports, dans Revue des archéologues et historiens d'art de Louvain, IX, 1976, p. 232-237.
3. A. Boschov, La peinture bulgare des origines au XIXe siècle, Recklinghausen, 1974, p. 90, ill. 20, p. 58. Boschov mentionne le Xe-XIe siècle pour l'icone centrale et le XVe ou XVIe siècle pour l'encadrement.

REMERCIEMENTS

Nous remercions monsieur R. De Roo, conservateur en chef des Musées royaux d'art et d'histoire à Bruxelles et madame J. Lafontaine-Dosogne, chef de travaux dans la même institution pour nous avoir facilité le travail.

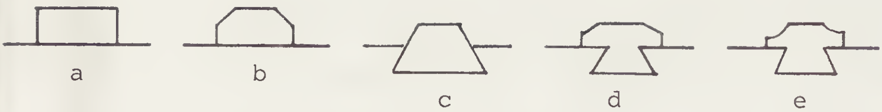


Fig.1 Profil des traverses appliquées (a,b) et incrustées (c, d et e)

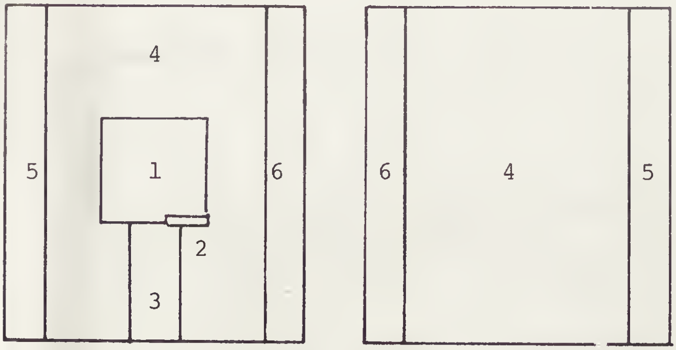


Fig.2 Support face et revers de l'icone de saint Georges et saint Dimitri, Sofia, musée d'archéologie et de l'église (inv. 3140) (catalogue, n° 28). Schéma.

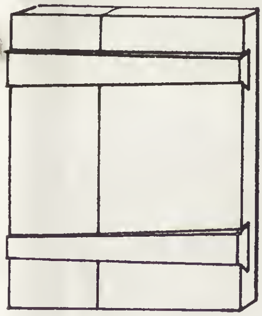


Fig.3 Traverses en "fuseau", incrustées à sens alterné.

Fig.4 Icone de saint Georges et saint Dimitri, Sofia, musée d'archéologie et de l'église (inv. 3140), catalogue (1) : n°28.

81/24/7

LA METHODE COMPLEXE DE L'ETUDE ET DE LA RESTAURATION DES OEUVRES DE LA PEINTURE RUSSE ANCIENNE

I. Gorine

Comité pour la conservation de l'ICOM
6ème Réunion triennale
Ottawa 1981

Groupe de travail: Icônes

LA METHODE COMPLEXE DE L'ETUDE ET DE LA RESTAURATION DES OEUVRES DE LA PEINTURE RUSSE ANCIENNE

I. Gorine
Institut national de Recherches scientifiques pour la Restauration, WCNILKR
10 Khrestyanskaya pl.
109172 Moscou
URSS

En été 1980 dans le cadre du programme culturel "Jeux Olympiques-80", l'Institut national de recherches scientifiques pour la restauration du Ministère de la culture de l'URSS a organisé une petite exposition de restauration, dont la signification était particulière. L'exposition a réuni 60 oeuvres de la peinture russe ancienne (icônes) du XY sciècle de la cathédrale de la Dormition de l'ancien monastère de Kirillo-Biélozersk (aujourd'hui - le Musée-réserve de Kirillo-Biélozersk de la région de Vologda. Les icônes ont été exposées parallèlement avec leurs copies, faites dans la technique et la manière des icônes russes médiévales. On a exposé également la documentation de restauration.

L'exclusivité de cette exposition a été determiné par un nombre de raisons considérables. Par la quantité d'oeuvres, le degré de leur integrité et par leur qualité artistique, l'iconostase de la Cathedrale de la Dormition est une des plus complètes et représentatives parmi les iconostases russes parvenues jusqu'à nos jours du XY siècle.

Les oeuvres de cette iconostase peuvent être classées dans le même rang que les meilleures oeuvres non seulement de l'art russe médiévale, mais de l'art mondial aussi. Elles sont la preuve du talent peu ordinaire des maîtres russes de la peinture d'icônes, de leur compréhension profonde de la philosophie de la vi et de l'art.

Et finalement, ce qui est le plus important pour les spécialistes de restauration, cette exposition a été conçue et faite par l'Institut comme une exposition des méthodes scientifiques modernes de restauration des icônes russes. Nous sommes convaiçus que l'avenir appartiendra à ces méthodes, qui correspondent aux exigeances les plus élevées, émises à la restauration des oeuvres d'art. La conférence nationale, organisée au mois de novembre 1980 lors de la clôture de cette exposition, a confirmé nos suppositions.

L'Institut de restauration a commencé les travaux de recherche et de restauration sur ces oeuvres au milieu des années 60. Dès le début ce travail de grande échelle et de l'importance particulière a exigé pour son exécution une approche complèxe 1). La méthode

---

1) Le Musée-réserve de Kirillo-Biélozersk du XY-XVIIIss comporte 12 églises, des iconostases, des peintures murales, un grand nombre d'oeuvres d'art appliqué et

de la restauration traditionnelle de l'oeuvre, extraite de son milieu culturel et historique, dans ces conditions n'était pas convenable.

L'application de la méthode complèxe est devenue possible grâce au développement harmonieux des méthodes et des principes scientifiques de restauration des oeuvres historiques et culturelles, grâce à l'existance au sein de l'Institut de grand nombre de spécialistes-restaurateurs, d'historiens d'art, de physiciens, de chimistes, de biologistes, d'ingênieurs, d'archéologues, capables de résudre les tâches différentes, et également grâce à l'organisation correcte de tout le processus de restauration.

Les travaux sur les icônes incluaient les recherches dans les archives et les réserves de musée, l'analyse historique et d'histoire d'art. Il est à noter, qu'au début des travaux il manquait dans cette iconostase 25 icônes sur 60. Elles ont été emportées du monastère et leurs traces étaient perdus. Cependant toutes ces icônes ont été retrouvées dans différents musées, elles étaient datées différemment ou l'on considérait leur ori-

---

décoratif, une grande collection d'icônes, de livres anciens, de manuscripts, etc. Les travaux sur ces oeuvres sont effectués parallèlement. L'exposition de Moscou n'a réuni que les icônes de la fin du XVs de l'iconostase de la Catherdrale de la Dormition.

gine comme inconnue ou indéterminée. Les spécialistes de l'Institut en se basant sur les analyses comparatives et sur les autres études ont prouvé leur appartenance à l'iconostase de la Cathédrale de la Dormition.

On a procédé aux analyses et études physiques, chimiques et biologiques des supports de bois (des planches), des "pavoloka" (toiles collées sur le support de bois), des"levkas" (préparations), des pigments, des liants, des pellicules de protection, on a exécuté tous les travaux de conservation et de restauration liés au nettoyage des icônes, enlèvement des repeints et à la nécessité d'assurer la conservation prolongée des oeuvres d'art uniques. En même temps on a étudié les objets d'art appliqué et décoratif faisant partie de l'intérieur de la Cathédrale.

La plupart des élaborations scientifiques nouvelles proposées par le Département des peintures de chevalet en détrempe est le résultat de cette approche complèxe. Parmi elles, par exemple, se trouve l'étude sur les couleurs des icônes russes du XV siècle, la réception des pellicules de recouvrement plus stables, le choix des solvants et des pâtes lors de l'enlèvement des surpeints, la méthode de la séparation et de la transposition des couches anciennes des peintures sur de nouveaux supports, le choix et l'utilisation des pigments organiques pour la restauration des dorures, des préparations, des lacunes sur les objets d'art appliqué.

La méthode complèxe de la restauration a suggéré également la nécessité de la résolution des problèmes, liés à la vie ultérieure de l'oeuvre unique. On a fait des constructions démontables des revêtements en argent appliqué pour avoir toujours la possibilité de les monter ou de les démonter sans dommage à l'oeuvre et d'ouvrir les fonds dorés originaux d'auteur. Les revêtements du XVI-ème siècle présentent aussi une grande valeur artistique et historique.

En même temps avec la restauration des icônes, nous avons commencé à faire les copies exactes de toutes les 60 icônes dans la technique et la manière des maîtres russes anciens pour les installer insuite dans l'iconostase de la Cathédrale où le régime de la température et de l'humidité est instable, ce qui permettrait d'assurer la conservation des oeuvres anciennes en les installant dans l'exposition du Musée-réserve sur le territoire de l'ancien monastère. Nous nous proposons par la suite d'accomplir la reconstitution complète de l'intérieur de la Cathédrale pour lui rendre son aspect de la fin du XV siècle, ce qui sera un service inappréssiable pour l'histoire de l'art russe ancien.

L'importance des travaux communs des spécialistes différents consiste à la conduite conjointe des travaux de recherche et de restauration. Cette approche ammène à une méthode de l'analyse objective des oeuvres, à leur caractéristique complète, elle facilite la tâche de l'attribution, garantie la restutition de l'état original des oeuvres et assure incontestablement leur conservation.

Outre cela, l'approche complèxe ouvre de larges possibilités de la mise au point de la théorie de restauration des oeuvres historiques et culturelles scientifiquement argumentée; elle contribue également à l'augmentation de la qualité des travaux de restauration en général, devient une bonne école pour beaucoup de spécialistes nationaux, qui augmentent le niveau de leur qualification au sein de l'Institut. Pour eux, qui se familiarisent avec les étapes différentes de la méthode complèxe de l'étude et de la restauration, l'objectif final de tout le processus de restauration devient tout autre.

Aujourd'hui l'Institut mène ses travaux sur tout un nombre d'autres objets, et sur la base de ces travaux il planifie l'organisation des expositions de restauration. Pour l'école soviétique de restauration c'est un nouveau pas en avant, encore plus important, dans sa théorie et la pratique, qui correspond au niveau contemporain du développement de le science et de la technique, aux objectifs de la protection et de la restauration des oeuvres historiques et culturelles.

33 118318

GETTY CENTER LIBRARY CONS
N 8554.5 I61C73 1981 BKS
v.4 c. 1 ICOM Committee for C
Preprints /
3 3125 00228 5589